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ETNOECOLOGIA E MANEJO LOCAL DE PAISAGENS ANTRÓPICAS DA FLORESTA OMBRÓFILA MISTA, SANTA CATARINA, BRASIL.

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Orientador: Prof. Dr. Nivaldo Peroni

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Árvore

Um passarinho pediu a meu irmão para ser sua árvore.
Meu irmão aceitou de ser a árvore daquele passarinho.
No estágio de ser essa árvore, meu irmão aprendeu de
sol, de céu e de lua mais do que na escola.
No estágio de ser árvore meu irmão aprendeu para santo
mais do que os padres lhes ensinavam no internato.
Aprendeu com a natureza o perfume de Deus
seu olho no estágio de ser árvore aprendeu melhor
o azul.

E descobriu que uma casa vazia de cigarra esquecida
no tronco das árvores só serve pra poesia.
No estágio de ser árvore meu irmão descobriu que as árvores são
vaidosas.

Que justamente aquela árvore na qual meu irmão se transformara,
envaidecia-se quando era nomeada para o entardecer dos pássaros
e tinha ciúmes da brancura que os lírios deixavam nos brejos. Meu
irmão agradecia a Deus aquela permanência em árvore porque fez
amizade com muitas borboletas.

Manoel de Barros

Dedico essa dissertação a minha família querida que amo muito.

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RESUMO

As características ecológicas de uma paisagem, e como ela é percebida e usada por seres humanos, tem sido o foco da etnoecologia da paisagem. As mudanças que ocorrem neste nível de organização podem ser medidas pela composição de espécies e dados fitossociológicos, bem como pelo estudo das estratégias de manejo florestal históricos que existem ou existiram. Em termos de ecologia histórica, que lida com as pessoas e suas interações temporais com o meio ambiente, as sociedades humanas transformam seus ambientes coadaptativamente. No planalto norte de Santa Catarina, as paisagens são mosaicos compostos por fragmentos florestais e áreas de cultivo e de pastagem em meio à Floresta Ombrófila Mista (FOM). Comunidades rurais locais denominam alguns desses fragmentos florestais como caívas. Caívas são unidades heterogêneas dentro de paisagens culturais, que consistem de um sistema tradicional de manejo florestal com base na extração da erva-mate e uso do pinhão. Assim, o objetivo deste estudo é caracterizar o manejo das paisagens culturais, onde as caívas estão inseridas, bem como compreender o conhecimento ecológico tradicional associado e como estes contribuem para a conservação da Floresta Ombrófila Mista por meio do uso da biodiversidade. Além disso, este estudo tem como objetivo investigar como o uso de espécies arbóreas transformou a paisagem da FOM. Este estudo foi realizado na região norte de Santa Catarina, na Floresta Nacional de Três Barras (FLONA) e em cinco comunidades rurais no entorno. Para entender como diferentes áreas da FOM são utilizadas e manejadas, seis agricultores familiares foram convidados a identificar e descrever unidades de paisagem encontrados dentro de suas propriedades. Para avaliar a estrutura e composição da floresta de espécies arbóreas devido ao manejo local da FOM, um levantamento fitossociológico foi realizado em 25 parcelas permanentes alocadas em caívas nas propriedades. Para avaliar a percepção etnoecológica, uso histórico e as técnicas de manejo de caívas, entrevistas semi-estruturadas, entrevistas "checklist" e turnês guiadas foram realizadas com 28 unidades familiares. No total foram registradas 11 unidades de paisagem, com diferentes formas de manejo, aonde Myrtaceae, Lauraceae e Aquifoliaceace foram as famílias mais comuns e *Ilex paraguariensis* foi a espécie mais abundante em quase todas as unidades de paisagem. Duas percepções de caívas foram encontrados, que seguiram um padrão dependendo da relação da unidade familiar com as praticas de manejo. Onze tipos de manejo florestal diferentes

foram encontrados, e uma mudança marcante foi a impossibilidade de recolher lenha da caíva associadas às prerrogativas da legislação ambiental, entre outros fatores. A caíva pode ser considerada um ecótopo dentro de uma paisagem cultural. O extrativismo de erva-mate continua sendo uma das principais razões pelas quais as caívas ainda existem, assim como a tradição e a utilização do pinhão de araucária. Uma vez que a maior parte dos remanescentes da FOM são encontradas dentro de propriedades privadas, e não dentro de unidades de conservação, é fundamental conciliar os praticas tradicionais de manejo e uso dos recursos vegetais, nas estratégias de conservação desta fitofisionomia no sul do Brasil.

Palavras-chaves: floresta ombrófila mista, caívas, etnoecologia, ecologia histórica.

ABSTRACT

The ecological features of the landscape, and how the landscape is perceived, and used by people who live in it, has been the focus of the Landscape ethnoecology. The changes in landscape can be measured through species composition and phytosociological data as well as studies of historic land management strategies that exist or existed. In terms of historical ecology, which deals with people and their interactions with the environment through time, human societies transform their environments dialectically. The *Araucaria Forest*, is a typical ecosystem of southern Brazil, belonging to the Atlantic Forest Biome. In the northern plateau of Santa Catarina, the landscape is a mosaic composed of forest fragments, as well as areas of cultivation and pastures. Local rural communities denominate some of these forest fragments as *caívas*. *Caívas* are cultural landscape units with a traditional forest management system based on the extraction of erva-mate and the use of the pinhão (araucaria's seed). The objective of this study is to characterize the management of cultural landscapes, where the landscape unit *caíva* is found, and the associated traditional ecological knowledge, and how these contribute to conservation of the Araucaria Forest through the use of biodiversity. Furthermore, this study aims to investigate how the use of tree species has transformed of the Araucaria Forest landscape. This study was conducted in the northern region of Santa Catarina, in the Três Barras National Forest (FLONA) and five surrounding rural communities. To understand how different Araucaria Forest areas are used and managed, six rural landowners were asked to identify and describe landscape units found within their properties. To assess forest structure and tree species composition due to local management of the Araucaria Forest a phytosociological survey was conducted within 25 permanent plots in forest fragments within rural properties. To assess ethnoecological perceptions, historical use and types of forest management within *caívas,* 28 semi-structured interviews, checklist interviews and guided tours were conducted with family units. A total of eleven landscape units with different forms of management were identified where Myrtaceae, Lauraceae, and Aquifoliaceace were the most common families and *Ilex paraguariensis* was the most abundant species in almost all landscape units. Two perceptions of *caívas* were found, that followed a specific pattern related to the family units relationship with management practices in caívas. Eleven different *caíva* forest managements were found, and one of the most highlighted changes was the inability to collect firewood from the

caíva due to environmental regulations of the Brazilian Forestry Code and the Atlantic Forest Law. A *caíva* can be considered a ecotope within a cultural landscape. The extraction of erva-mate continues to be one of the primary reasons why the *caíva* still exists, as well as tradition and the use of the araucaria's pinhão (seed). Since most of the Araucaria Forest remnants are found within private property, and not within conservation units, it is fundamental to reconcile the traditional management practices and plant resource use, in strategies of conservation for this phytophysiognomy in Southern Brazil.

Keywords: araucaria forest, *caívas*, ethnoecology, historical ecology.

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SUMÁRIO

1. INTRODUÇÃO GERAL

As relações entre seres humanos e a natureza são complexas e podem ser estudadas através de várias abordagens teóricas, como por exemplo pela etnoecologia e pela ecologia histórica. A etnoecologia procura compreender o conhecimento ecológico local, ou em outras palavras, as maneiras que grupos de pessoas percebem e interagem com os ecossistemas e o meio ambiente onde vivem. Esse conhecimento leva em consideração aspectos ecológicos da visão das populações locais, que inclui aspectos bióticos e abióticos, em diferentes escalas temporais e espacias (Toledo & Barrera-Bassols, 2010).

O conhecimento ecológico local é importante para a conservação e manejo da biodiversidade (Hanazaki, 2003; Toledo & Barrera-Bassols, 2010). A conservação da biodiversidade tem benefícios diretos na vida das populações locais, sendo que muitas populações locais dependem desses recursos para sobrevivência (Alcorn, 1995). Um aspecto que pode ser explorado quanto ao conhecimento ecológico local, envolve o manejo de áreas de floresta, também como o manejo de recursos naturais pelas populações locais. Muitas comunidades tem suas próprias maneiras de manejo e uso da biodiversidade, em geral, os usos e ações de manejo acabam tendo influencias grandes sobre os ecossistemas (Berkes et al., 2000).

Durante os últimos anos, a etnoecologia, emergiu como uma área do conhecimento que tem avançado teórica e metodologicamente na compreensão abrangente do uso e manejo de paisagens (Toledo & Barrera-Bassols, 2005). Com o pretexto semelhante, a ecologia histórica visa estudar as interações entre seres humanos e seu meio ambiente porém incorporando uma perspectiva temporal. A ecologia histórica está preocupada com as paisagens em um contexto histórico, cultural, e evolutivo, focando nas interações das sociedades com seus ambientes (ecossistemas) ao longo do tempo, também considerando e analisando as consequências dessas interações (Crumley, 1994; Balée, 2010). As interações no caso da ecologia histórica podem ser vistas como manejo, uso, e conhecimento dos ambientes, numa escala temporal-espacial. A ecologia histórica contesta a ideia determinista da adaptação humana aos ambientes de florestas, articulando que as sociedades humanas não tem simplesmente se adaptado aos seus ambientes mas sim têm transformado os mesmos e sendo também transformadas (Balée, 2010).

Etnoecólogos usam o conceito de paisagem para entender como os seres humanos interpretam concepções locais, padrões e classificações de paisagem, e também sobre como os sistemas locais de

conhecimento podem ajudar na sustentabilidade ecológica (Johnson & Hunn, 2009; Johnson, 2010).

Há pouca informação sobre classificação de paisagens sob um ponto de vista etnoecológico, especialmente quanto a classificação de unidades heterogêneas percebidas e manejadas, que apresentam algum significado particular, e que se destacam por apresentar uma característica específica, podendo serem chamadas de *ecótopos* (Hunn & Meilleur, 2009).

Ecótopos são definidos como "categorias naturais" na medida em que determinadas espécies de plantas e/ou animais serão previsivelmente associadas a certas manchas. Hunn & Meilleur (2009) afirmam que a classificação etnoecológica de paisagens é importante e serve para o propósito de integrar os dados etnobiológicos (classificação de plantas e animais) com dados etnogeograficos.

Usando a perspectiva de ecologia histórica, a análise em nível de paisagem possibilita conhecer a composição de espécies, especialmente aquelas utilizadas como recursos, para as sociedades humanas, bem como as estratégias de manejo que existem ou existiram ao longo da história do local (Balée, 2006). As paisagens etnoecologicas também podem ser consideradas como paisagens culturais (Johnson & Hunn, 2009). Muitas comunidades humanas tem transformado suas paisagens pelo uso da biodiversidade e manejo florestal (Crumley, 1994; Winthrop, 1998; Balée, 2006). Isso pode ser visto em muitos exemplos no mundo todo, como nas praticas de queima dos aborígenes da Australia (Vigilante, 2004), e no uso das florestas tropicais pelos indígenas da America Central (Toledo & Barrera-Bassols, 2010), indígenas da Indonesia (Hakim, 2009), e os indígenas na Amazonia Brasileira (Posey, 2002; Balée, 2010).

Um exemplo bem documentado, da influência humana em florestas tropicais, é do uso e expansão da espécie *Bertholletia excelsa* (castanha-do-Pará), conhecida também como "castanha-do-Brasil (Sherpard & Ramirez, 2011). Através de uma análise integrada de dados históricos, etnoecológicos, linguísticos, e genéticos, estes autores demostraram que esta espécie sofreu uma forte influencia antrópica em sua dispersão devido principalmente ao uso de suas sementes por grupos indígenas amazônicos. Devido ao uso e manejo da espécie, Shepard & Ramirez (2011), destacam ainda que grandes áreas de floresta tiveram sua estrutura e composição alteradas pelo homem ao longo do tempo. Estudos como esse demonstram que muitas áreas de floresta, muitas vezes consideradas "virgens" ou pristinas (Clement & Junqueira, 2010),

na verdade são florestas transformadas historicamente pelo manejo e uso humano (Heckenberger et al., 2007).

Não há muitos estudos sobre essa perspectiva na Mata Atlântica, e bem menos na Floresta Ombrófila Mista. A Floresta Ombrófila Mista (FOM) é um ecossistema pertencente ao bioma Mata Atlântica (IBGE, 2012). Klein (1978) divide a Floresta Ombrófila Mista em duas subformações: Floresta dos Pinhais e Floresta dos Faxinais. Na primeira subformação predomina araucárias de grande porte com submatas densas e desenvolvidas, com espécies da família das lauráceas (Klein, 1978). A segunda subformação apresenta pinheiros de menor porte e submata baixa, com predominância de mirtáceas e aqüifoliáceas, entremeadas por taquarais e carazais (Klein, 1978).

O Sistema de Classificação Fitogeográfica é adotada por Teixeira et al. (1986) que distingue quatro subformações para a FOM: aluvial, submontana, montana e alto-montana. Segundo o IBGE (2012) a composição florística da vegetação são classificadas de acordo com altitude em quarto subformações: Aluvial (ao longo de flúvios), Submontana (50-400 metros de altitude), Montana (400-1000 metros de altitude) e Alto-montana (>1000 metros de altitude). Alêm disso, suas subformações que são em grande parte caracterizadas pela submata, e constituídas por árvores em diferentes áreas de ocorrência, onde a floresta também é interrompida por campos ou capões (Klein, 1978; Brandt, 2012). A composição de espécies desse ecossistema pode variar significativamente com latitude, altitude, tipo de solo, e microclima (Reitz & Klein, 1966). Muito da submata da FOM é constituída por espécies da família Myrtaceae (IBGE, 2012), vários estudos fitossociológicos encontraram essa família como a mais abundante em fragmentos florestais (Klauberg *et al*., 2010; Carmo & Assis, 2012).

Este ecossistema ocorre na maior parte do estado do Paraná, extendendo-se pelo planalto de Santa Catarina, até o estado do Rio Grande do Sul (IBGE, 2012). Atualmente não existe mais do que 12.6% da área original da FOM, e algumas de suas espécies arbóreas, como a *Ocotea porosa* e *Araucaria angustifolia* são oficialmente registradas como espécies ameaçadas de extinção (Ribeiro et al., 2009).

A paisagem da Floresta Ombrófila Mista no sul do Brasil vem sendo transformada e modificada desde o fim do Holoceno. A região do planalto norte em Santa Catarina foi primeiramente influenciado por tribos indígenas durante séculos, e durante o século XIX pelos tropeiros que passavam pela região vindo do Rio Grande do Sul e começaram a se estabelecer na região (Hanisch, 2006; Carvalho & Nodari, 2010).

Desde sua ocupação, o Planalto Norte do Estado de Santa

Catarina tem uma ligação com a extração da erva-mate (*Ilex paraguariensis*) e com a extração de madeira (Hanisch, 2006), porem a expansão da agricultura e tecnologia causou uma mudança em foco para cultivo de milho, feijão e soja. Atualmente a paisagem do planalto norte é um mosaico de áreas de cultivo, inseridas entre remanescentes de floresta ombrófila mista. Algumas cidades atuais, como Três Barras, foram fundadas inclusive a partir da exploração madeireira (Serraglio & Pimenta 2011).

A erva-mate foi um dos principais produtos da região, porem perdeu valor econômico para a extração da madeira. A partir da construção da *Southern Brazil Lumber & Colonization Company*, conhecida como Lumber, na segunda metade do século XX a extração de madeira começou a ganhar mais importância como um recurso florestal, devido a fácil saída da madeira do Planalto de Santa Catarina ao porto de São Francisco do Sul, SC, aonde a madeira era exportada para outros países. Com a chegada do Lumber as áreas de floresta começaram a ser valorizadas a partir do número de araucárias presente nas propriedades que ali existiam. A Lumber também comprou muitos áreas de Floresta Ombrófila Mista e trouxe colonizadores para explorar essas áreas e extrair os recursos madeireiros. Estas mudanças, também influenciaram a estrutura sociocultural da região, uma vez que a Lumber também foi responsável por influenciar a expansão e colonização de imigrantes poloneses, alemães, italianos, eslavos, ucranianos, japoneses, portugueses, sírio-libaneses e turcos, acrescida da influência cabocla e tropeira (Carvalho & Nodari, 2010).

Além do manejo local da erva-mate dentro de fragmentos florestais de FOM, há também outras formas de manejo de outras espécies, como de suínos, e a exploração de duas espécies em particular, a araucária e a erva-mate, contribuiu para a formação de um sistema típico chamado faxinal (Löwen-Sahr & Cunha, 2005; Grzebieluka & Löwen-Sahr, 2009). Neste sistema os suínos e outros animais são criados no sub-bosque das florestas e alimentam-se de frutas e sementes de espécies nativas. O faxinal ainda existe como um sistema no estado do Paraná, porém, em Santa Catarina, este sistema parece não ser mais utilizado. O manejo local de áreas de FOM também influenciou no surgimento de unidades de paisagem com denominações específicas. Uma dessas denominações, conhecido como caíva, é usada para áreas determinadas em fragmentos florestais. As caívas constituem-se de um mosaico florestal, formados por fragmentos entremeados por áreas de cultivo (Hanisch *et al*., 2010). Marques et al. (2008) descreve caívas como "ecossistemas de vegetação remanescente de florestas nativas -

com diferentes níveis de adensamento florestal - cujos estratos herbáceos são compostos por pastagens nativas e/ou naturalizadas, extensivamente pastejadas." Nessas unidades de paisagem com um estrato arbóreo de FOM é realizada o manejo da erva-mate.

Há pouca informação sobre a composição e estrutura florística de caívas (Hanisch *et al*. 2010). Existem trabalhos do conhecimento local de uso de plantas especificas como o *Ilex paraguariensis* (Mattos, 2011), e a *Bromelia antiacantha* (Filippon, 2009). Porém, há poucos trabalhos sobre o conhecimento local do uso de plantas em geral e manejo dessas pelos agricultores com caívas em suas propriedades. Uma vez que as caívas fazem parte de propriedades, sua conservação aliado ao conhecimento local pode contribuir para a conservação da flora e fauna local do ecossistema da FOM (Hansich *et al*., 2010).

Entre os anos de 2008 a 2011, foi iniciado o projeto denominado Conservabio com atuação do Núcleo de Pesquisas em Florestas Tropicais (NPFT) da Universidade Federal de Santa Catarina, Embrapa, Epagri e ICMBio. O projeto teve como objetivo a produção e conhecimento científico e tecnológico para a conservação e uso sustentável dos recursos vegetais da Floresta Ombrófila Mista para favorecer políticas públicas, diversificar uso de espécies em sistemas agroflorestais, e recuperação de áreas degradadas, além de agregar valor e renda as comunidades ao redor das Florestas Nacionais. Esta dissertação utiliza parte dos dados provenientes deste projeto, particularmente quanto aos levantamentos fitossociológicos executados nas caívas.

Assim o objetivo geral deste estudo foi de entender como as populações locais do Planalto Norte de Santa Catarina tem transformado suas paisagens pelo uso e manejo da Floresta Ombrófila Mista, bem como compreender o conhecimento ecológico local e como estes contribuem para a conservação da FOM por meio do uso da biodiversidade. A hipótese geral desse trabalho é que as populações locais do Planalto Norte de Santa Catarina transformaram e conservaram a paisagem da FOM pelo uso e manejo de áreas de floresta e espécies arbóreas nativas que são percebidas como recursos importantes.

Os objetivos específicos são:

a) Caracterizar o histórico do manejo e o conhecimento ecológico local do ecótopo caíva da Floresta Ombrófila Mista.

b) Avaliar as formas de manejo e o uso de espécies arbóreas das caívas por populações locais.
c) Avaliar a composição e estrutura fitossociológica, a diversidade, e a riqueza de espécies nas caívas, considerando as formas de manejo e percepções locais.
d) Avaliar os efeitos dos uso e manejo local e suas potencialidades para conservação da biodiversidade.

A dissertação está estruturada em dois capítulos na forma de artigos para publicação, e em seguida há as considerações finas dos dois capítulos.

O primeiro capítulo caracteriza o ecótopo caíva usando uma abordagem etnoecologica. A caracterização é feita a partir do conhecimento ecológico local de manejo atual e histórico, e uso de espécies arbóreas pelos agricultores locais no Planalto Norte de Santa Catarina, abrangendo cinco comunidades.

O segundo capítulo a área de estudo foi somente em duas comunidades, Colônia Escada e Campininha. Essa parte do estudo considerou um levantamento fitossociologico feito em áreas de caívas, também como os usos e manejo para cada área de caíva. Além disso também foi feito um estudo fitossociologico dentro da Floresta Nacional de Três Barras, visando utilizar esta área como uma área de controle para comparar com as áreas de caívas manejadas.

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2. *CAÍVAS*: CULTURAL LANDSCAPES OF THE ARAUCARIA FORESTS IN THE NORTHERN PLATEAU OF SANTA CATARINA, BRAZIL.[1]

ABSTRACT

The Araucaria Forest is associated with the Atlantic Forest biome and is a typical ecosystem of southern Brazil. The expansion of *Araucaria angustifolia* had a human influence in southern Brazil, where hunter-gatherer communities used the *pinhão*, araucaria's seed, as a food source. In the north of the state of Santa Catarina, the Araucaria Forest is a mosaic, composed of cultivation and pasture areas inserted between forest fragments, where *pinhão* and *erva-mate* are gathered; some traditional communities denominate some these forest ecotopes as *caívas*. Therefore, the aim is to understand how human populations transform, manage and conserve landscapes using the case study of *caívas* from the Araucaria Forests of southern Brazil, as well as to evaluate the traditional ecological knowledge and how these contribute to conservation of the Araucaria Forest. This study is being conducted in the northern plateau of the state of Santa Catarina, Brazil in five communities. To assess ethnoecological perceptions the historical use and management of *caívas*, semi-structured interviews, checklist interviews and guided tours were conducted with family units. In total 28 family units participated in the study that had *caívas* on their properties. During the course of the study two perceptions of the ecotope *caíva* and eleven management practices within *caívas* were found. *Caívas* are perceived and defined through the management practices and native plant resources of the Araucaria Forest. All informants stated that there have been many changes to the management practices within *caívas* and to the *caíva* itself. These areas still remain today due to cultural tradition, use and management of plant resources. Through this cultural tradition of maintaining *caívas* the vegetation of the Araucaria Forest has been conserved.

[1]This article is formatted to be published in the Journal of Ethnobiology and Ethnomedicine.

2.1 INTRODUCTION

In the past decades there has been a significant growth in the number of research studies about use and management of natural resources by traditional and local societies (Toledo & Barrera-Bassols, 2010). This growth can be attributed to the rise in consciences regarding the earth's ecological crisis, as well as the lack of evidence if in a modernized world people are capable of using natural resources sustainably (Toledo & Barrera-Bassols, 2010). The conservation of natural resources and biodiversity is important, however, most of the world's areas of biodiversity are in areas used by human populations (Berkes & Davidson-Hunt, 2006). In order to conserve biodiversity it is important to understand how human populations interact with their environments and landscapes and shape them into cultural landscapes (Berkes & Davidson-Hunt, 2006).

One way to undestand how humans interact with their environments and landscapes is through the traditional ecological knowledge. Traditional ecological knowledge (TEK), is a term used to describe the knowledge and beliefs that traditional communities hold of their environments, which maybe knowledge that is passed along through generations (Menzies & Butler, 2006), and includes knowledge of species, and beliefs of human interactions with the environment (Berkes, 1999).

Traditional communities generally have large repertoire of ecological knowledge (Toledo & Barrera-Bassols, 2010) and many communities recognize certain ecogeographic areas or landscapes units (Toledo & Barrera-Bassols, 2010) based on the principal sets of vegetation, or plant associations (Johnson & Hunn, 2009; Abraão *et al*., 2009). For example in Mexico, indigenous groups recognize landscape units in the environment where they live, for example, the Huastecos recognize nine landscape units in tropical forests (Toledo & Barrera-Bassols, 2010). In the Brazilian Amazon, the Baniwa of the Upper Rio Negro have many distinct habitats, with specific vegetation that they classify associations of specific biotic characteristics (Abraão *et al*., 2009). The Kayapo of the Amazon region use 16 different terms to categorize different vegetation in the amazon forest (Posey, 2002). Many of these landscape units are described through associations with vegetation, topography, type of soil, ecological indicators, fauna, hydrology, and through different types of use carried out in each area (Toledo & Barrera-Bassols, 2010).

These landscapes units are called ecotopes in the context of landscape ethnoecology (Hunn & Meilleur 2009). Ethnoecologists use the concept of landscape to conduct studies on how humans interpret "local conceptions of landscape", landscape patterns and classifications, and some study the "local knowledge systems for ecological sustainability" (Johnson & Hunn, 2009; Johnson, 2010).

Many of forest areas maintain a high level of biodiversity that depends directly on resource use and renewal of ecosystems (Berkes & Davidson-Hunt, 2006), and this biodiversity exists because of a rich historical ecology created by human populations (Clement & Junqueira, 2010). Forests around the world in large part have been transformed into cultural landscapes (Berkes & Davidson-Hunt, 2006), many forest landscapes are influenced by natural disturbances, as well as disturbances by people (Cunningham, 2001; Clement & Junqueira, 2010). The vegetation patterns, which result from disturbances, reflect complex interactions between biotic and abiotic characterisitics (Cunningham, 2001), as well as cultural characteristics (Berkes & Davidson-Hunt, 2006). For example, the Brazilian Amazon is considered more of a garden (Heckenberger et al., 2007) where biodiversity and landscape features have been transformed through many years of traditional management systems (Balée, 2010; Clement & Junqueira, 2010). These traditional management systems and use of biodiversity has transformed many environments into cultural landscapes. The term cultural landscape may also be used to describe how people view, use and occupy their land (Johnson & Hunn, 2009; Oliveira, 2010). Cultural landscapes have been transformed by cultural forces and in large part are responsible for the patterns of biodiversity; however, these can only be understood historically (Heckenberger *et al*., 2007).

Forests are not merely viewed as timber resources but also places with non-timber forest products; this can be attributed to the understanding of traditional management practices, and the consistency of human practices with landscape and biodiversity conservation (Berkes & Davidson-Hunt, 2006). There are many types of forest management, which can range from specific species management to large-scale managmenet of timber, along with secondary sucession management, agroforestry, management of non-timber forest products, as well as others. Cultural forces of ecosystem land use drive many of these management practices.

In the Brazilian Atlantic Forest, there are many local populations, which depend on the extraction and management of natural

resources for their survival and livelihood (Pinto *et al*. 2009; Pilla & Amorozo, 2009). Traditional and local populations do not only depend on tropical forests for use of natural resources but also as a source of income (Alcorn, 2005). In many regions around the world, these traditional communities and their traditional management systems contribute to local ecosystem and biodiversity maintenance (Balée, 2006; Erickson, 2008).

In the southern Atlantic Forest biome, the Araucaria Forest is a typical ecosystem (IBGE, 2012). The Araucaria Forests are protected under the Atlantic Forest Law (BRASIL, 2006). The ecosystems' area has been significantly reduced due to logging exploitation, deforestation and expansion of urban areas (Ribeiro et al. 2009; Sonego & Backes 2007). The Araucaria Forest is distributed in a major part of the state of Paraná, and extensive areas in the states of Santa Catarina and Rio Grande do Sul (IBGE, 2012). Currently no more than 12.6% of the original area of Araucaria Forest exists (Ribeiro et al. 2009).

The Araucaria Forest has been transformed and changed since the end of the Holocene (Bitencourt & Krauspenhar, 2006). After the nineteenth century, the native species, *Ilex paraguariensis* (*erva-mate*) became highly valued economically for many human populations, who depended on this resource as a source of income (Mattos, 2011; Brandt, 2012). Along with the extraction of erva-mate began the management of livestock in the understory of the Araucaria, and the exploitation of both species contributed to the formation of a typical system called *faxinal* (Grzebieluka & Löwen-Sahr, 2009; Löwen-Sahr & Cunha, 2005). In this traditional management system, pigs and other animals are raised in the understory and feed on fruits and seeds of native tree species. Thus, the *faxinal* is considered a traditional system that permits the survival of various plant communities and from a landscape perspective is an ecologically viable system (Löwen-Sahr & Cunha, 2005). The local management of Araucaria Forest has influenced landscape units with specific denominations. The *faxinal* does not exist as a management system in the state of Santa Catarina; however, *caívas* exist with similar current and historical management practices.

In the northern plateau of Santa Catarina the Araucaria Forest landscape is a mosaic formed by forest fragments in between cultivation areas (Hanisch *et al*., 2010). Marques et al. (2008) describes *caívas* as an "ecosystem made up of native forests - with different densities - whose herbaceous strata is composed of native and/or naturalized pastures that are extensively grazed." *Caívas* can be seen as landscape units or ecotopes with tree strata of the Araucaria Forest and herbaceous layer

composed of pastures, where the livestock are raised and erva-mate is extracted (Mattos, 2011).

Regarding the *caívas* there is not much information on their floristic composition, structure, and management. There also is no consensual definition for *caívas* within scientific literature, as well as within traditional communities. *Caívas* can be an essential part in contributing to the conservation of the flora and fauna of the Araucaria Forest. Hanisch (2010) argues that in regions of intense anthropogenic pressure there are difficulties in establishing conservation reserves due to fragmentation, and accordingly the *caíva* presents an alternative to conservation units.

This study looks to answer how human populations conserve and transform forest landscapes through use, and management? Therefore, the aim is to understand how human populations transform, manage and conserve landscapes using the case study of *caívas* from the Araucaria Forests of southern Brazil. More specifically, we aim to characterize this ecotope through the study of the perceptions of local populations in regards to use, management and used species. Furthermore, this study seeks to exemplify how local populations have conserved these spaces of Araucaria Forests through use and management of landscapes currently and historically.

2.2 METHODS

2.2.1 STUDY AREA

This study was conducted in six communities within four municipalities in the northern plateau of the state of Santa Catarina: Campininha, Barra Grande and KM 6 in the municipality of Três Barras, Colônia Escada in the municipaility of Irineópolis, Colônia Ruthes in the municipality of Major Vieira and Forquilhas in the municipality of Canoinhas.

The communities of Campininha, Barra Grande and KM 6, located in the municipality of Três Barras (Figure 1) were founded in the 19th Century (Filippon, 2009; Mattos, 2011). The area was mainly used to raise cattle, extract erva-mate and logging (Mattos, 2011). There are various immigrant ethnicities in the region, including Polish, a smaller number of Germans, Italians and Lebanese.

The second community, Colônia Escada, is located in the municipality of Irineópolis (Figure 1). Beginning in 1885 immigrants of various descents, such as German, Polish, Ukrainian, and to a lesser

extent Italian, began to colonize the area that is known as Irineópolis. The primary source of income for people of Colônia Escada is agriculture.

The history of Canoinhas and Major Vieira municipalities are linked. These municipalities were colonized by *tropeiros* in 1880, who crossed from Rio Grande do Sul to São Paulo transporting cattle and became interested in the rich earth and thus established roots in what was then called Colônia Vieira (IBGE, 2012). After the *Guerra do Contestado*, both areas were colonized by primarily Polish immigrants in search of better opportunities. Other immigrants of German, Italian, Ukrainian and Japanese descent also colonized the area during the early 1900's because of the erva-mate (Filippon, 2009).

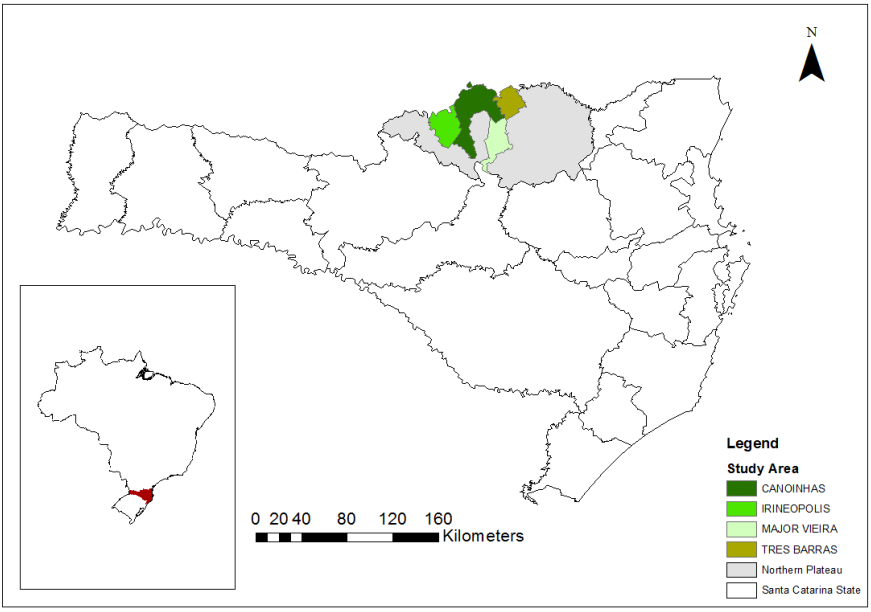


Figure 1. Map of study area in the Northern Plateau of Santa Catarina. Campininha, KM 6 and Barra Grande are located in the municipality of Três Barras, Colônia Escada is located in the municipality of Irinéopolis, Forquilhas is located in the municipality of Canoinhas, and Colônia Ruthes is located in the municipality of Major Vieira. (Constructed with ArcGis by Juan Manuel Otalora & Anna Jacinta Machado Mello).

2.2.2 DATA SAMPLE, INTERVIEWS, GUIDED TOUR & PLANT COLLECTION

Within each community informants were accessed based on their willingness to participate and the presence of *caívas* on their properties. The informant sample was increased using the "snow-ball" method (Bernard, 1995; Albuquerque et al., 2010). This method is non-probabilistic and used when there is difficulty in finding sampling units, in this case, informants that have and manage *caívas*. Two households refused to be interviewed, and two households were never home when accessed. The total number of landowners in the northern plateau region that actually have *caívas* on their properties is not known but one study estimated that 80% of landowners in the northern plateau have *caívas* on their properties (Marques et al. 2008).

Semi-structured interviews were conducted at the household level and this is considered the sample unit (family unit) (Appendix 1). The interview contained some structured questions and some open-ended questions regarding the local ecological knowledge, management, and resources from *caívas* or the Araucaria Forest.

Before beginning the study, a prior informed consent was conducted (Appendix 2), which explained the objectives and nature of the study, and probable outcomes, in accordance with the code of ethics of the International Society of Ethnobiology and a legal Provisional Measure (MP n° 2.186-16 - 23/08/2001) (Álvares, 2005; ISE, 2006). The study was also approved by the ethics committee of the Federal University of Santa Catarina (CAAE: 01262212.5.0000.0121).

After the semi-structured interview a "checklist-interview" (Campos & Ehringhaus, 2003) of 20 plants was carried out to access local ecological knowledge on a group of plants deemed as priority by local populations (Appendix 1). The list was derived from a previous project (*Conservabio* project[2]) that conducted studies using participatory research tools/approaches (de Boef *et al*., 2007) in the community of Campininha and Colônia Escada (Peroni et al. 2009). One of the results of the study was a list of what the communities considered to be the

[2] Conservabio is a project conducted in during the years 2008-2010. The project Conservabio was done through partnerships between the Núcleo de Pesquisas em Floresta Tropicais (NPFT) at Federal University of Santa Catarina, Embrapa (Brazilian Company for Agricultural Research), EPAGRI (Company for Agricultural Research and Rural Extension in Santa Catarina) and ICMBio (Chico Mendes Institute for Biodiversity Conservation). For more information on the project Conservabio please see Peroni *et al*. 2009 and Boef *et al*. 2013.

most important non-timber forest resources from the Araucaria Forest. From this list the first 20 species were chosen and the goal of the "checklist-interview" technique was to further gain knowledge on the 20 species within the other four communities. For each species all informants were asked to cite current use, historical use, management (which part was utilized), frequency of use, and availability of the resource.

The species from the list were the following: Caraguatá (*Bromelia antiacantha* Bertol.), Espinheira-santa (*Maytenus ilicifolia* Mart. ex Reissek & *Maytenus boaria* Molina.), Araucaria (*Araucaria angustifolia* (Bertol.) Kuntze), Cataia (*Drimys brasiliensis* Miers.), Erva-mate (*Ilex paraguariensis* A.Sant.-Hil.), Pau-de-andrade (*Persea major* (Meisn.) L.E.Kopp), Bracatinga (*Mimosa scabrella* Benth.), Cedro (*Cedrela fissilis* Vell.), Guavirova (*Campomanesia* sp.), Cambará (*Gochnatia polymorpha* (Less.) Cabrera), Cerninho (*Curitiba prismatica* (D.Legrand) Salywon & Landrum), Cuvatã (*Cupania vernalis* Cambessedes), Guamirim (*Myrcia* sp.), Imbuia (*Ocotea porosa* (Nees & Mart.) Barroso), Pau-amargo (*Picramnia parvifolia* Engler), Pitanga (*Eugenia uniflora* L.), Araça (*Psidium cattleianum* Sabine), Ariticum (*Annona* sp.), Canela guiaca (*Ocotea puberula* (Rich.) Nees), Aroeira (*Schinus terebinthifolius* Raddi).

After each interview a guided tour was marked with each informant who was available. Guided tours were conducted in order to collect, identify and verify plant material mentioned during the interview (Albuquerque et al., 2010). The collection of botanical material followed the standard procedure for ethnobotanical studies (Cunningham, 2001), and the species were identified using specific bibliographies and consultation with botanical experts using the APGII system (Angiosperm Phylogeny Group II system) of plant classification. Specific plant material from the family Lauraceae and Myrtaceae were sent to experts at the National Institute of Forestry in São Paulo and the University of São João Del-Rei in Minas Gerais. Remaining plants were deposited in the collection of the Human Ecology and Ethnobotany Laboratory at the Federal University of Santa Catarina, and the FLOR Herbarium at the Federal University of Santa Catarina, Brazil. The collection of plant material was approved by the Chico Mendes Institute for Biodiversity Conservation (ICMBio/MMA) and the System of Authorization and Information of Biodiversity (SISBIO) emitted on January 7th 2012 (case number: 32055-1).

2.2.3 DATA ANALYSIS

The data analysis consisted of a qualitative description and use of descriptive statistics. The answers were separated into themes, or similar answers and organized into tables utilizing direct information from the household interviews. The botanical material was used to verify if the plant named was the same taxonomic species for all informants.

The answers from the "checklist interview" were organized into a table according to Campos & Ehringhaus (2003). For the current and historical use species were sorted into five categories: timber/firewood, medicinal, animal consumption, edible (food & drink), and tools. For the frequency of use each plant was sorted into three categories: always uses (1), sometimes uses (2), almost never uses (3). The availability of the plant was separated into four categories: very abundant (1), not abundant (2) and does not exist (3). The proportion of use, frequency, and availability were calculated for each category following Campos & Ehringhaus (2003). Some informants said they did not use a plant or did not know the plant so they were not included within the calculated proportion.

A nine-cell analysis was designed to compare availability of the plant in *caívas* with its current frequency of use. Graphs were made using Microsoft Excel to compare the percentage of current use and historical use citation within the five use categories.

2.3 RESULTS

In total 28 family units participated that were indicated through the snowball method. Of the 28 family units three were from the community of Colônia Escada, two from Forquilhas, two from Colônia Ruthes, one from KM 6, eight from Barra Grande, and 12 from Campininha. The average female age in households was 53.3 ranging from 20 to 75 years of age. The average male age was 56, ranging from 26 to 82 years of age. Informants were culturally mixed mostly of Polish, German, Italian and Turkish descent, as well as Caboclos.

The property sizes ranged from 2 hectares (ha) to 50 ha, with an average of 15 ha. Out of 28 family units 26 have properties larger than 1 ha. The average size of *caívas* on these properties was 8.5 ha, ranging from 0.2 ha to 45 ha.

The main source of income for family units is agriculture, and the main crops planted are beans, corn, tobacco, and soybeans. Some of

these families also plant potato, wheat, rice and medicinal plants, as well as *Pinus* spp. and *Eucalyptus* spp. Families live primarily from retirement benefits, agriculture, agro and forest companies, maintenance crew of the National Forest of Três Barras, rural tourism, cattle raising for milk, poultry farming, erva-mate extraction and beekeeping.

2.3.1 LOCAL PERCEPTIONS AND CHARACTERIZATION OF THE ECOTOPE *CAÍVAS*.

When family units were asked if they knew the origin of the word *caíva*, all informants stated that it was a word that had always been used by their parents and grandparents and therefore they continued to use the word. Three family units (10.7%) guessed that it might be an indigenous word, but were uncertain. The word *caíva* actually comes from the tupi language, a now extinct indigenous language, and means "earth improper for cultivation" (Ferreira, 1999; Assis, 2011).

The local perception of *caívas* was separated into two categories. Figure 2a and 2b elucidate the two different perceptions. The first perception, cited by 21 (75%) of family units, is centered around the three main resources and management found within *caívas*, which include raising cattle on native pastures within forest areas, extraction of erva-mate, and the presence of araucária and taller but not dense vegetation. The second perception of *caíva* is the exact opposite and was cited by seven informants (25%). People holding this perception considered the first perception to refer to general forest cover, where some management is exerted, but considers a caíva to be originating from "*roça de toco*" management. A area from "*roça de toco*", is considered an forest area cleaned for swidden cultivation, where the *tocos* (stumps) are left, afterwards the area is burned, and traditional agricultural crops are planted among the stumps. After this area is used for cultivation it is left alone for many years so that the natural vegetation may return (fallow area). Two family units who held this perception said their parents always called them to "clean the *caíva*".

The family units with the first perception were property owners with large properties. These families were generally those that had a higher socioeconomic status, in terms of land ownership. These were also families who employed members of the family units holding the second perception. Those who thought *caívas* are fallow areas from swidden cultivation (*roça de toco*), were generally those who were

employed in erva-mate extraction, trimming/slashing and caring for the land and cultivation.

There were slight variations to the first perception within the 21 (75%) family units; some said the presence of cattle was not necessarily found in a *caívas*, some stated the contrary, that what makes a *caíva* is the presence of cattle. Others stated that every type of native tree could be found. Some households stated that *caívas* did not exist anymore because of the Environmental Brazilian Law (Brazilian Forestry Code and the Atlantic Forest Law), which does not permit the use of natural resources from the forest without a management plan. Some only stated that a *caíva* was forest area where the animals were kept to feed on native pasture, which they stated is synonymous with a *potreiro* or *invernado*. Some informants stated that a *caíva* is a forest area where the herbaceous layer was removed/mowed in order to for cattle to graze on the native pastures. A few family units stated that firewood was extracted from *caívas*. However, all 21 family units stated that without use and management the area is no longer considered a *caíva*.

There were also slight variations in the second perception of *caívas*. One family unit said the difference between forest area and a *caíva* was the presence of specific species, such as, bracatinga (*Mimosa scabrella* Benth.). Furthermore the family unit went on to say that *caívas* are more like a *capoeiras* (swidden fallow), and the presence of bracatinga represents a good planting area. Another informant stated that a caíva is "*terra de plantar*", cultivation area, with very short non-dense vegetation that could also have the presence of araucária (*Araucaria angustifolia*). Two other informants stated that *caívas* were areas with *roçadas* and *queimadas* (slash and burn), which were left alone afterwards for short less dense vegetation to grow.

a) Illustration of the first perception for *caíva*, taken in the community of Colônia Escada.

b) Illustration of the second perception for *caíva*, taken in the community of Barra Grande.

Figure 2a-b. Examples of the *caíva* landscape for each of the two perceptions found in the communities of KM6, Barra Grande, Campininha, Colônia Escada, Forquilhas, and Colônia Ruthes located in the Northern Plateau of the state of Santa Catarina, Brazil.

2.3.2 MANAGEMENT PRACTICES IN *CAÍVAS*

Eleven management practices were found for areas of *caívas*. The 11 management practices, as well as how many family units currently exercise this management within areas of *caívas* are listed in Table 1. Two family units (7%) stated that their families managed *caívas* in the past (historical management), however due to the legal restrictions by Environmental Brazilian law they prefer not to continue management in forest areas. One informant stated "I maintain *caívas* out of tradition, it was the way my father had always done it so I do it too."

The most common management practices within *caívas* were the gathering of firewood from fallen trees and branches, cattle grazing on native pastures in the forest understory, the trimming of the herbaceous layer, and the extraction of erva-mate. All family units remove the herbaceous layer yearly, independent of the tool used. The herbaceous layer is removed to facilitate the extraction of erva-mate leaves and to create easier access to native pastures for cattle. The cattle also help maintain this area clean and clear of herbaceous layers.

The gathering of erva-mate leaves is done in order to make erva-mate for the traditional drink called *chimarrão* (maté tea). *Chimarrão* is consumed daily and is often a replacement for coffee. The drink is made in a gourd cup called a *cuia*. The dried and crushed erva-mate leaves are poured to fill the *cuia*. Afterwards hot water is poured over the erva-mate and the *bomba*, a metal straw with tiny holes at the end, is inserted into the drink. After the drink is prepared the *cuia* is passed around to each person present, every person drinks one *cuia* then fills the *cuia* again with hot water and passes to the next person.

The extraction of erva-mate is done by 92.8% (26) family units every 2-5 years depending on the family unit's traditions and kind of management used. The gathering of erva-mate used to be a community gathering, however, due to some legal restrictions surrounding worker's rights, erva-mate industries are now hired for this process. The leaves are "sold on the tree" by 39% (11) of family units, where the family sells the leaves of the trees that the erva-mate business removes. Of the 92.8% of family units who extract erva-mate, 53% gather their own erva-mate and sell the leaves to the erva-mate industries. For more detailed information on the extraction of the erva-mate in this area see Mattos (2011).

Other species are pruned in order to reduce the trees size, generally because the species is creating too much shade for the erva-mate or reducing space for the erva-mate to grow. The cattle's function

is not only to graze on native pastures but also to help maintain the area clear of ferns and other herbaceous species. Only one species was mentioned specifically in relation to pruning, which was the cerninho (*Curitiba prismatica*). This species is a fast growing shrub, which 82% of family units called a "pest". These family units went on to say that the species has taken over their *caívas* and that they must remove the species yearly. Two informants said they favor cerninho because it is a species with a hard core to be used as wood for building fences.

Ten informants (35.7%) favor erva-mate, that is, they favor this species over others within the *caíva*, making sure of its survival. Four informants (14.3%) also said they favor other species. The other species cited were *Maytenus* spp (espinheira-santa) and *Araucaria angustifolia* (araucaria). Firewood is essential, all informants have traditional wood stoves, and during the winter temperatures may drop to zero degrees, so the wood stove is essential for household heating. All informants said their firewood is from the *caíva*. As firewood they use fallen branches and trees, only one family unit said they also cut down trees for firewood.

Table 1. Management practices found in *caívas* by 28 family units from communities of the Northern Plateau, Santa Catarina, Brazil.

Management practice	Description	% Family units	Observations
Firewood	Pick up firewood from forest floor for personal use	100% (28)	Most people stated they pick up wood from the floor because removing firewood by cutting trees is now illegal but they still depend on firewood so they remove fallen trees or branches from the *caíva*.
Cattle	Maintain cattle within *caíva* to clean herbaceous layer and feed on native pastures.	92.8% (26)	Most families have between 5 – 20 heads of cattle grazing within *caívas*. The cattle only graze on native pastures during the summer months, in the winter they are also supplemented with oats.
Trimming	Removal of herbaceous layer with a scythe	92.8% (26)	The traditional way of removing the herbaceous layer.
Pruning/collection of erva-mate	Pruning erva-mate with a machete or scissors, or breaking by hand	92.8% (26)	Most families use a machete or pruning scissors, however three family units mentioned breaking the species by hand.
Plant erva-mate	Planting erva-mate within areas of *caívas*	78.6% (22)	Plant native erva-mate (*Ilex paraguarienesis*) that grows in the shade.
Mowing	Removal of herbaceous layer with tractor or gas powered weed cutter	78.6% (22)	Most families use gas powered weed cutter, only 5 families use a tractor and the weed cutter.

Plant other species	Planting other species within areas of *caívas* or forest	53.6% (15)	Other species planted are *Pinus ellioti*, *Eucalyptus* sp., *Maytenus* spp (espinheira santa), *Persea major* (pau-de-andrade) and *Picramnia parvifolia* (pau-amargo).
Pruning	Pruning other species with machete or scissors to reduce size	39.3% (11)	The species that is most removed is cerninho (*Curitiba prismatica*).
Favoring erva-mate	Favoring erva-mate within *caíva* or forest area, making sure the species survives over others	35.7% (10)	Most families remove other tree species around erva-mate in order to increase its growth.
Favoring other species	Favoring other species within *caíva* or forest area, making sure the species survives over others	14.3% (4)	The other species that are favored are espinheira-santa (*Maytenus* spp) and the araucaria (*Araucaria angustifolia*).
Chop firewood	Cut down trees for firewood for personal use	3.6% (1)	Only one family unit mentioned cutting trees with a saw for firewood.

2.3.3 PLANT RESOURCES FROM *CAÍVAS*

Twenty native species previously recognized by the local farms as priorities within *caívas* are displayed in the nine-cell analysis (Figure 3). The twenty species are the primary resources utilized from *caívas*. The analysis shows the distribution of the twenty species according to how frequently it is used and its availability within *caívas*. In the interview process the number 3 corresponds to a low availability and low frequency, and the number 1 corresponds to a high availability and high frequency of use. The species that are said to be highly abundant are also used with a higher frequency, and the species that are not readily available are used with a low frequency. However, some species, such as, *espinheira-santa*, *bracatinga*, *pitanga*, and *araça* are used with a medium-high frequency but have a low availability. Thirteen out of twenty species are found to have low use frequency and low availability.

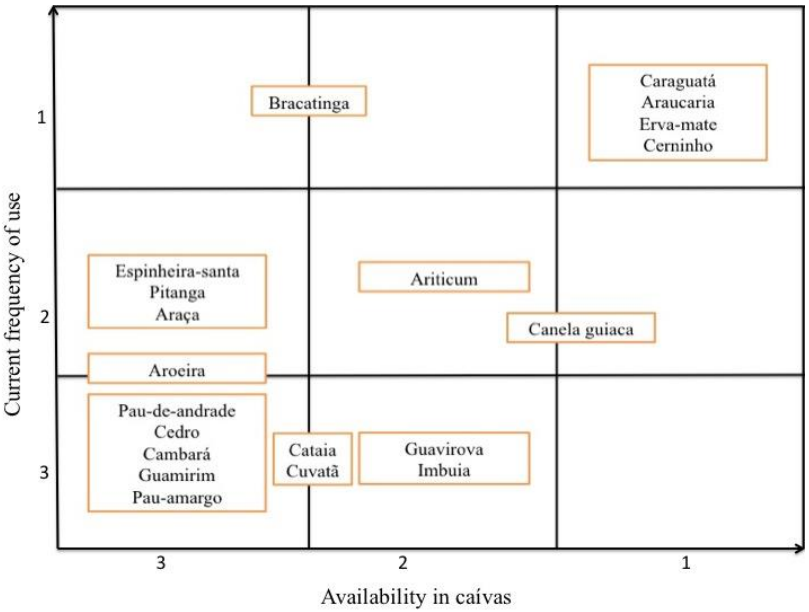


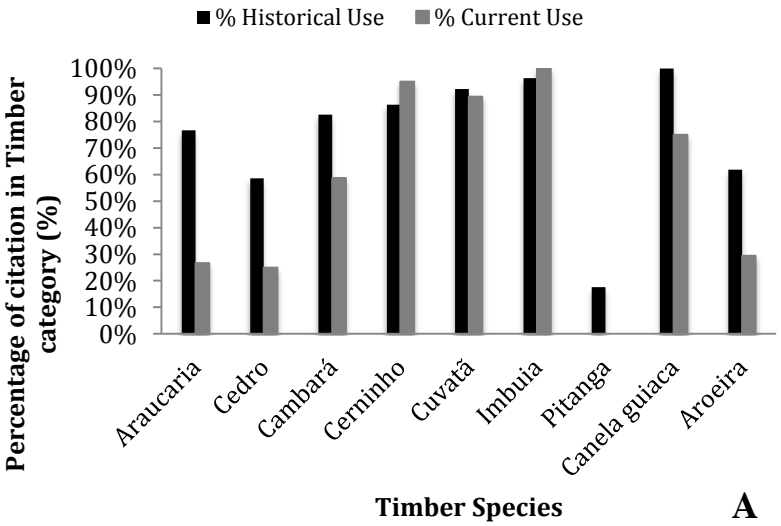
Figure 3. Nine-cell analysis demonstrating the distribution of twenty native species recognized as priority within *caívas* according to availability and current frequency of use. The number 3 corresponds to a low frequency and availability and the number 1 to a high frequency and availability.

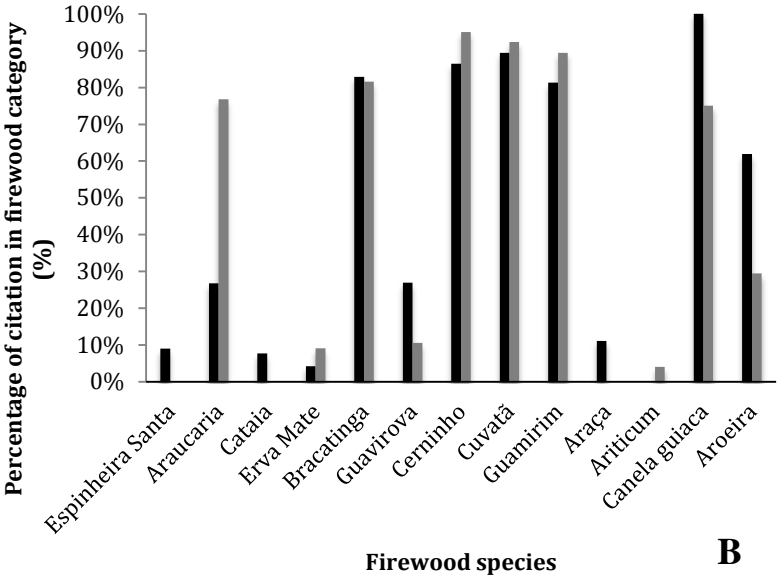
Only four species had high frequency of use and high availability, which were cerninho (*Curitiba prismatica*), araucaria (*Araucaria angustifolia*), erva-mate (*Ilex paraguariensis*) and caraguatá (*Bromelia antiacantha*) (Figure 3). More information regarding the specific use of each species can be found in Appendix 3.

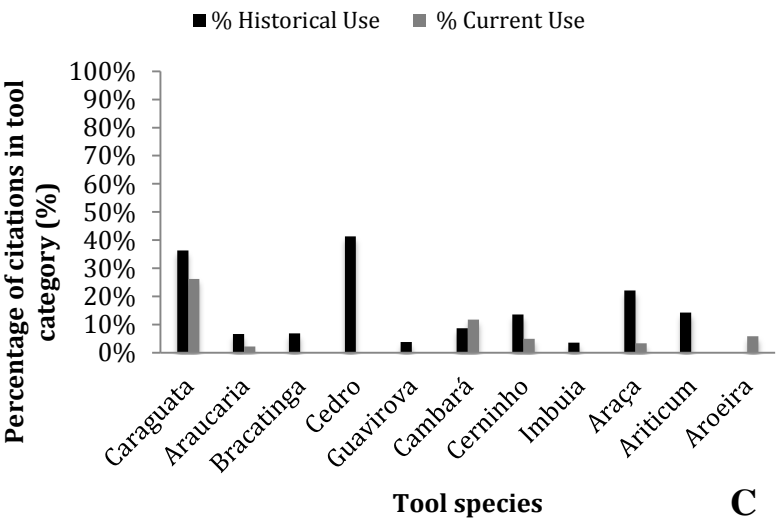
For many of the twenty species the category of use changed temporally. Figure 4A-F demonstrates the temporal changes in the past 30 years for the different use categories. There has been a general decrease in current use for timber species (Figure 4A). For example, the araucaria species was used almost 80% solely for timber historically, but the most cited use currently for this species is as food (the araucaria's seed *pinhão*). In general citations for species used as timber resource decreased from historical use to current use.

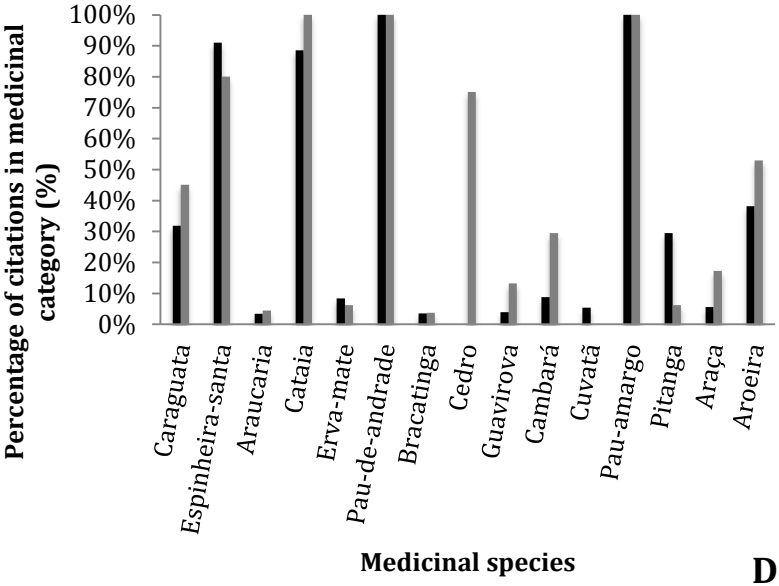
For firewood species (Figure 4B) the same pattern can be found. In general species that were used for firewood historically have changed. There are some exceptions, such as the araucaria that has a larger current use than historical use, since its fallen branches are used for firewood. But nowadays in this case the farmers do not have cut and down the trees as used to do in the past. The other exceptions are the bracatinga, a species historically only used for firewood, guamirim, cuvatã and cerninho, which have replaced other species that were used historically for firewood. The use of species cited in the tool category has decreased currently. Most of the species used as tools are cited currently as no longer used or have decreased in use over time (Figure 4C). For medicinal plants, the current use and historical use has remained relatively the same, with the exception of the species cedro (*Cedrela fissilis* Vell.) (Figure 4D). Cedro was cited in the past as primarily (95%) timber species but currently is only cited as a medicinal species (80%).

Food species have remained the same in terms of current use and historical use (Figure 4E), with the exception of the araucaria, which has increased in citation currently, compared to historically. Animal food has also generally remained the same between current and historical use citations (Figure 4F). Some species have appeared currently as being used for animal food that did not appear historically for this purpose. Four out of the eleven species cited in this use category are from the Myrtaceae family, which was stated by family units to provide fruit for livestock along with the native pastures within *caívas*. For more information on current and historical frequency, species use and availability please see Appendix 3.


% Historical Use
% Current Use
Percentage of citation in Timber category (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Araucaria
Cedro
Cambará
Cerninho
Cuvatã
Imbuia
Pitanga
Canela guiaca
Aroeira
Timber Species
A


Percentage of citation in firewood category (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Espinheira Santa
Araucaria
Cataia
Erva Mate
Bracatinga
Guavirova
Cerninho
Cuvatã
Guamirim
Araça
Ariticum
Canela guiaca
Aroeira
Firewood species
B


% Historical Use
% Current Use
Percentage of citations in tool category (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Caraguata
Araucaria
Bracatinga
Cedro
Guavirova
Cambará
Cerninho
Imbuia
Araça
Ariticum
Aroeira
Tool species
C


Percentage of citations in medicinal category (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Caraguata
Espinheira-santa
Araucaria
Cataia
Erva-mate
Pau-de-andrade
Bracatinga
Cedro
Guavirova
Cambará
Cuvatã
Pau-amargo
Pitanga
Araça
Aroeira
Medicinal species
D

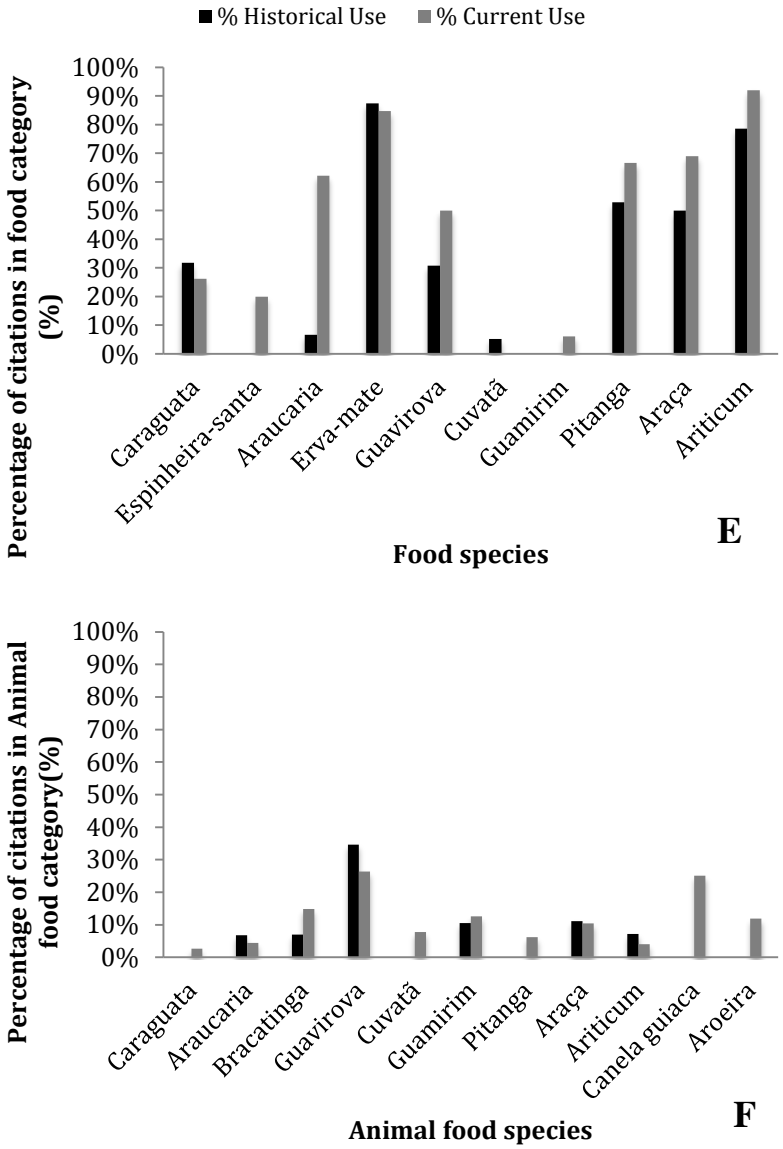


Figure 4A-F. Percentage of current and historical use citation for twenty native species considered priority within *caívas* for six communities of the northern plateau of Santa Catarina, Brazil. Citations in the following categories: A) Timber; B) Firewood; C) Tool; D) Medicinal; E) Food; F) Animal food.

2.3.4 SPATIAL AND TEMPORAL CHANGES IN *CAÍVAS*

There are three categories of change, economic, cultural and legislative, that can be analyzed regarding the changes faced by the local farmers. All informants stated that there have been many changes to the management practices in *caívas* and to the *caíva* itself within the last thirty years.

The most stated change, due to legislation, cited by 57% of family units, was the ability to collect firewood from the *caíva*. More specifically, they cited that they were no longer able to use bracatinga (*Mimosa scabrella*), which used to be their primary source of firewood. Ten informants said they also sold bracatinga wood before it was prohibited. All family units said that the worst thing the environmental law disallowed was the use of fire in forest areas and because of the law the bracatinga is becoming less common.

The second most cited change, which is economic, stated by 53.5% of family units, was the decreasing value of erva-mate. All said that the erva-mate is not worth as much, economically and culturally, as it was in the past. In the past erva-mate extraction was a collective community activity, stated by 35.7% of family units. All 53.5% of family units stated that in the past erva-mate cultivation and extraction was the primary source of income, along with raising cattle in the *caíva*.

Another economic change mentioned by 32% of family units is the use of timber resources. Most families stated that their houses are all made with wood from their *caívas*, generally *Araucaria angustifolia* and *Ocotea* spp. Formerly informants were able to sell the araucaria to supplement their income. Furthermore, the family units stated this was the biggest change for them, because the araucaria has a high economic value as a timber resource. Almost 18% of family units stated that they do not conserve the araucaria anymore since its use is prohibited and the araucaria consumes space for other resources. Instead the araucaria seedlings found within *caívas* are removed, since the species is found on the endangered species list and cannot be cut without authorization after a specific diameter. Thus, many landowners decide to remove the araucaria as a seedling in order not to have problems with legislation in the future. The araucaria seed, *pinhão*, is only seen as a resource to be used within the household and not to supplement income. In relation to changes in species all family units said that the cerninho (*Curitiba prismatica*) is a species that grows abundantly within *caívas* but is considered a pest.

Some of the changes stated were that *caívas* do not exist anymore, now forest areas once considered *caívas* must be legally conserved by Brazilian environmental legislation. Furthermore, that *caívas* were of high value historically, both economically and culturally, but do not have the same value currently. One informant only maintains the *caíva* out of tradition, and 14% used to take greater care of their *caívas* when able to use its resources. One informant stated that, "before the *caíva* was the future and profit, our children's inheritance, now it's just capital we cannot use". Lastly, 14% said that the *caívas* used to be the source of income for the family but now it has no value.

The third most cited change is cultural and had to do with the division of land, cited by (43%) of family units. These family units stated that formerly the whole community was one large *caíva* and that there were no property lines or divisions with fences. One informant said, "it was all one land without fences", another said, "it was a shared area where livestock were all raised together, and no one knew whose pig was whose". All informants mentioned livestock being raised free within the *caívas* and that they fed on native fruits. In relation to livestock, family units mentioned how cattle and pigs remained within *caívas* year round feeding on native pastures and fruits, and now since the land was divided they had to plant winter crops to feed the animals. One family unit said they only conserve their *caívas* because of their livestock.

When asked what the best use was for the *caíva*, the family units stated the following: plant other species like pine and eucalyptus (exotic species), plant bracatinga and guavirova (*Campomanesia* sp.) both good for firewood, plant more native fruit trees, plant espinheira-santa (*Maytenus* spp) and pitanga (*Eugenia uniflora*), exploit timber resources (Ocotea spp), improve native pasture areas for cattle, exploit *pinhão* to make flour, increase livestock, increase and conserve araucaria, conserve to exploit timber resources, manage native tree species, there is no more good use, reduce area of *caívas* for cattle crops. The most cited "best use" by 50% of family units was to decrease amount of cerninho and increase amount of erva-mate within the *caíva*. Another best use cited by 14% was to change *caívas* into cultivation areas. Lastly, cited by 11%, to take care of the *caíva* because of the erva-mate and the araucaria.

2.4 DISSCUSION

Caíva is a word that has been used throughout the northern plateau of Santa Catarina, perceived both through management practices, as well as plant resources of the Araucaria Forests. *Caívas* are ecotopes in a cultural landscape of the Araucaria Forests, modified and transformed through management practices and extraction of natural resources. In general the *caívas* are not seen merely as forest fragments with management practices, but rather a place that is maintained out of tradition where plant resources can be used or planted and traditional management practices are exerted.

The focus of landscape ethnoecology is on how people perceive their landscapes, through traditional knowledge and management practices (Johnson & Hunn, 2009). Within the study there were two fundamental perceptions of *caívas*, which was directly related to the relationship the family unit had with the management practices and plant resources. The relationship of 75% of family units with *caívas* is related to management practices of raising and feeding livestock within the forest understory to maintain the *caíva* and facilitate the extraction of erva-mate and other plant resources, which are traditions persistent from the past, for most participants since the time of their grandparents.

Landscape ethnoecology however is not just concerned with naming and definition of specific places, but rather is also concerned with the traditional ecological knowledge and use of natural resources, as well as culturally recognized landscape elements within those places (Johnson & Hunn, 2009). This approach is concerned with not only ecological factors but also cultural and anthropogenic factors of ecotopes. In this study the perspective of landscape ethnoecology allows the ecotope *caíva* to be seen as a complex association between native vegetation of the Araucaria Forest combined with management practices, which includes the extraction of some non-timber forest products. Maintaining *caívas* is a cultural tradition for the people of the northern plateau and these ecotopes are considered historical places. In the case of *caívas*, people make their income with the land, historically from timber products, and currently from non-timber forest products like erva-mate.

Landscape transformation can be seen through the management practices of removing the herbaceous layer. The cattle within caívas play an important part in the transformation of this landscape. The cattle serve to clean the herbaceous layer year round, feeding on many herbaceous plants and keeping the understory free of plants that may

interfere with the growth of the erva-mate. Cattle generally do not consume erva-mate plants, however they consume many fruits, which are provided by many native fruit plants such as, araça (*Psidium cattleianum* Sabine), pitanga (*Eugenia uniflora* L.), guamirim (*Myrcia* sp.), cerninho (*Curitiba prismatica* (D.Legrand) Salywon & Landrum), and guavirova (*Campomanesia* sp.) The family Myrtaceae is generally found to contribute the most to the floristic patterns of the Araucaria Forest landscape (Klauberg *et al*., 2010; Carmo & Assis, 2012; Mello, 2013 chapter 2 of this dissertation). In some subformations of the Araucaria Forest, the flora is primarily made up of the Lauraceae family, which occupies much of the middle canopy, and the Myrtaceae and Aquifoliaceae families that occupy the lower canopy layer (IBGE, 2012). In a phytosociological study of Araucaria Forest ecotopes, Mello (2012, second chapter) found that the understory o was primarily made of Aquifoliaceae, Lauraceae and Myrtaceae in the *caíva* ecotope. Throughout the year cattle are raised in the *caívas* to feed not only on native pastures but also native fruit trees. Cattle grazing may even promote tree regeneration (Darabant et al., 2007), principally in Araucaria Forests where bamboo is sometimes densely found, specifically in areas without cattle (Mello, 2013, second chapter of this dissertation), and bamboo may impede tree regeneration (Taylor & Zisheng, 1992; Holz &Veblen, 2006; Darbant et al., 2007).

Two species specifically favored by management practices are the erva-mate and araucaria, which provide the people of the northern plateau with a source of income from non-timber forest products, as well as being culture keystone species (CKS) for the region (Assis et al. 2010). In this study these were also two of the four species that were considered to have a high use frequency and availability. The erva-mate and the araucaria more than any other species have transformed the Araucaria Forest landscape, and are the most dominant species in almost all *caíva* landscapes (Mello, 2013, second chapter). These two species have been highly favored within this landscape since their products were and for some people still are the primary source of income. In landscape ethnoecology and historical ecology the latter can been seen as a feedback loop, where the landscape has an affect on peoples behaviors and peoples behaviors has an affect on the landscape (Crumley, 1994; Johnson & Hunn 2009; Balée, 2010). This is truly evident with the use of the erva-mate and the araucaria. People began making a living off of this species and in turn began to favor this species within the forest area, therefore generating its abundance and cultural symbol. Thus the *caíva*,

for most participants, is an ecotope where they favor and extract erva-mate, and historically did the same for araucaria.

Erva-mate currently is and historically was the primary source of incomes for most families in the northern plateau, where all family units once had a *Barbaqua* (Mattos, 2011). The cultural value of the species was related to the *Barbaqua*, which was a rudimentary system consisting of a *carijó*, wooden plank where erva-mate leaves were deposited and left to dry over a tunnel that produced heat via an underground furnace. The erva remained there for about twenty hours in order to complete roasting the leaves, and afterwards were passed into a perforated wooden structure where erva-mate leaves were grinded. The change in workers rights with the Brazilian law changed people's relationship to the species. Presently, erva-mate alone is not the primary source of income; it is coupled with other forms of income. However, erva-mate is still seen as an important resource and people in the region continue to plant and favor this species.

Of the two other species with high frequency of use and availability one is considered a management problem ("pest"), cerninho (*Curitiba prismatica*), and the other is a non-forest timber product, which is used as a medicinal plant for coughs and as a live fence, caraguatá (*Bromelia antiacantha*). Caraguatá was promoted traditionally as a live fence, and many family units used to surround their *caívas* with a live fence of this species in order to keep livestock from escaping.

The removal of firewood from the forest floor, either of fallen trees or branches is very important for those living in the northern plateau. This is not only a management practice within *caívas* but was mentioned as a significant change, most people stating that they could not use the species bracatinga (*Mimosa scabrella*) anymore, which previously was their primary source of firewood. The bracatinga is a fast-growing legume tree species and dominates generally in the early stages of sucession, it is considered illegal in relation to Brazilian environmental law to manage this species (Moreira, 2011; Steenbock, 2009). The bracatinga, also called "white firewood", is used because of its fast growth, its ability to create high-density stands, and its wood burns for a longer time. This species is also used for charcoal production in the northern plateau (Moreira, 2011). The bracatinga is a species of conservation interest for traditional communities in the northern plateau; some of them speak adamantly about the decline of this species, stating, "The bracatinga cannot be found anymore like before, it is going to disappear." As seen in the nine-cell analysis, the bracatinga has a high use frequency but its availability is considered to be low.

The loss of the bracatinga, according to the informants, is because of the prohibition of burning forest areas as a management practice. The family units say they must set fire to a specific area in order for the seeds to germinate. However, the practice of setting fire to forest areas is illegal and many of the informants feel they will be fined heavily by what they call IBAMA (*Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis),* which is the Brazilian Institute for the Environment and Renewable Natural Resources.

Steenbock (2009) worked directly on the use and social aspects of the bracatinga. In his research, he found that the bracatinga has a high economic and social value, and the species is characterized as a human artifact, and a product of gradual landscape domestication. He also found that the use of fire is common in the management of bracatinga, and to form dense areas of bracatinga called *bracatingais*. However, fire is not necessarily needed in order to grow bracatinga, removal of trees and soil disturbance is sufficient to promote bracatinga germination without fire, however, the removal of trees is costly and there is a greater number of germination when the are is burned (Steenbock, 2009). The bracatinga for the communities of the northern plateau is linked to the "*roça-de-toco*" or "*area de plantar*", which is the second perception of *caívas*. These areas were used to cultivate various food crops like beans, corn, soybeans, and tobacco. According to informants these areas were burned periodically, and after planting when left alone the first species to begin regeneration of this area was the bracatinga. They state that there was always an area in regeneration, and therefore the bracatinga was always available as a resource. If there were no areas in regeneration they would burn a small piece of land to germinate bracatinga.

Fire is a management tool that has transformed landscapes in many places (Erickson, 2006; Berkes & Davidson-Hunt, 2007; Bowman & Haberle, 2010; Chown, 2010; Perry et al., 2012) Brazil through slash and burn agricultural practices (Oliveira, 2010), as well as the management of specific species (Oliveira, 2010; Firme & Oliveira, 2010). Fire is one of the few human actions that can alter landscape so intensely, having the capability of drastically changing the structure and composition of forests (Firme & Oliveira, 2010). In the Atlantic Forest, as well as the Araucaria Forests, anthropogenic fires have played a major role in its mosaic, as it is used to clear areas for crops, pastures (Carvalho, 2010; Brandt, 2012), and in some areas of the northern plateau for the species bracatinga (Steenbock, 2009).

In the checklist interview the change in plant use over time can be seen, especially with timber resources, where in current use many species are rarely cited as timber resources and in historical use, almost all native species were used as timber resources. This is also another change within *caívas*, where one informant stated: "we cannot use the wood we find in our own property, we now have to spend a lot of money to buy wood from somewhere else." For example, the araucaria is stated as currently primarily being used as a food source, whereas when comparing to historical use, 76% is as a timber resource. There are some current possibilities in Brazilian legislation to use lumber from native vegetation with a sustainable management plan, and some participants mentioned this possibility, however, they also said it was costly and the public organs responsible for foreseeing the management plans were not easy to navigate. Timber resources were highly proclaimed in the region, especially because of several lumber-mills, which promote the planting of two exotic species *Pinus* spp and *Eucalyptus* spp According to informants the decrease in timber species was due to lumber companies that came into the region, beginning in the early 1900's with the Southern Brazil Lumber & Colonization Company, a north American company. One informant stated that "Lumber took all the big imbuia's and araucaria's and left the small ones on our properties. Now we can't use any trees because of them."

Even though during the interviews the question regarding changes in law was not directly asked, many informants mentioned this change because of how the law caused a profound change in how they view and manage *caívas* and plant resources. Various legislative changes modified how people culturally manage erva-mate, the plant resources they may use, as well as the end to the *caíva* for some family units. Conservation of the Atlantic Forest has become very important, and the Atlantic Forest Law was defined in 2006 for the conservation of this biome. The Atlantic Forest Law was designed to conserve and regulate the use and management of remaining forest fragments (BRASIL, 2006). The law states that the Araucaria Forests are part of the Atlantic Forest Biome and therefore the native remnants of all vegetation types within the Atlantic Forest in primary and secondary regeneration stages (initial, middle, and advanced) will have its use and conservation regulated by law (BRASIL, 2006).

The Brazilian Forestry Code has also affected and changed the informants perceptions and relationship with caívas. Many informants consider the forest area, and not areas of *caíva*, to be legal reserves, for the conservation of the imbuia (*Ocotea porosa*) and the araucaria

(*Araucaria angustifolia*), along with other native trees. Legal reserves and permanent protected areas (APP's) are established under the Brazilian Forestry Code that has, as its objective, the sustainable development and use of native vegetation. The Forestry Code states that all rural properties must maintain an area of native vegetation; property owners must maintain 20% of native vegetation (BRASIL, 2012). Many of the family units have already changed their lands to legal reserves thereby discontinuing the management practices that once were tradition within *caívas*.

However, *caívas*, through the perception of the traditional communities, is not what Marques et al. 2008 considered, it is not an ecosystem with naturalized or native pastures. Through the perception of those who own *caívas*, it is not merely considered a forest fragment where some management is exerted, it is a place that would not exist without management, not all Araucaria Forest fragments are considered *caívas*. *Caívas* are places of tradition passed along and conserved through generations, where native vegetation is conserved because people use and rely on these resources for their daily lives, not only as a direct source of income, but indirectly through cattle grazing. Once people believed *caívas* were the future and now most people want to change *caívas* into cultivation land, since the law has discontinued many the use of forest resources and many management practices. The *caívas*, and it's native vegetation, only exist today because people have used and managed these areas, and continue to use the resources provided by the Araucaria Forest, therefore maintaining a cultural tradition.

2.5 CONCLUSIONS

Caívas are diverse and can be considered an ecotope in a cultural landscape mosaic. The two most abundant and important species for the people of the northern plateau is the erva-mate and the araucaria. However, the use and management of these species has changed over the years due to Brazilian environmental legislation. For example, araucaria changed from a timber resource to a food source. The cultural connotations of erva-mate collection have also changed due to new worker laws, and bracatingas cannot be used as firewood.

Species that were historically used as timber resources are no longer used. Species that were not historically timber resources became new timber resources because of their abundance, such as, cerninho. Species that were food resources continue to currently be seen as a food source, for humans and livestock. Many feel the loss of the ability to use

the resources found within their own properties therefore not promoting them to conserve the area, as stated by many family units “when we were able to use the resources we took better care of our *caívas*”. Erva-mate continues to be one of the primary reasons why the *caíva* still exists, as well as tradition and the use of the pinhão. However, most of the people of the northern plateau do not see *caívas* as a viable option due to the lack of ability to use resources and would prefer to turn these remnants into cultivation areas. Once the *caíva* provided an economic resource, with araucaria and erva-mate, as well as other resources, and without the use of these species the caíva becomes a low economic source for the family.

Landscape ethnoecology studies are important not only to value the traditional ecological knowledge, but also to understand the perception of communities in regards to ecotopes to better inform management practices that conserve forest areas. The informants perception of *caívas* once was an ecotope laden with resources, and therefore were conserved, and now without these resources the *caívas* have no value to its owners. There must be conservation of areas through regulated use that is easy to access by local communities. It would also be valuable to further investigate the relationship of the local communities with Brazilian environmental legislation, since it was mentioned throughout interviews but was not studied in depth. Other studies should also be done to further link the different views of management practices and plant resource use from the Araucaria Forest with socioeconomic and cultural information. The traditional communities of the northern plateau have conserved these areas, and sometimes even increase plant diversity (Mello, 2013, second chapter of this dissertation) through generations, and hope to pass this to generations to come. Their traditional knowledge of the forest and its uses is extensive and should be considered when aligning public policies to conservation practices.

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3. FITOSSOCIOLOGICAL AND CULTURAL FEATURES OF THE ARAUCARIA FORESTS IN THE NORTHERN PLATEAU OF SANTA CATARINA, BRAZIL.[3]

ABSTRACT

The ecological features of the landscape, and how the landscape is perceived and used by people who live in it, have been the focus of the Landscape ethnoecology. Many tropical and subtropical forests have experienced some anthropic forms of management, resulting in the formation of anthropogenic landscapes. The changes in landscape can be analyzed by species composition and phytosociological data as well as historic land management strategies that exist or existed. In terms of historical ecology, which deals with people and their interactions with the environment through time, human societies transform their environments dialectically. The Araucaria Forest, is a typical ecosystem of southern Brazil, belonging to the Atlantic Forest Biome. In the northern plateau of Santa Catarina, the landscape is a mosaic composed of cultivation and pasture areas and forest fragments. Local rural communities denominate some of these forest fragments as *caívas*. *Caívas* are ecotopes within a cultural landscape with traditional management practices. The objective of this study is to understand the management, diversity, structure and dynamics of tree species in cultural landscapes of the Araucaria Forest in order to conservation efforts through use of biodiversity. This study is being conducted in the northern region of Santa Catarina, in the Três Barras National Forest (FLONA) and two surrounding rural communities. To understand how different Araucaria Forest areas are used and managed, smallholders were asked to identify and describe landscape units found within their properties. To assess forest structure and tree species composition due to local management of the Araucaria Forest a phytosociological survey was conducted within 25 permanent plots in the *caívas* on the smallholder's properties. A total of eleven ecotopes with different intensities of management practices were identified where Myrtaceae, Lauraceae, and Aquifoliaceace were the most common families and *Ilex paraguariensis* was the most abundant species in almost all ecotopes. In a cluster analysis (UPGMA method) two main groups of ecotopes were found, ecotopes with high species richness and diversity, and ecotopes

[3] The article is formatted following the guidelines for publishing in the Journal of Forest Ecology and Management.

with intense management, where, in general, one species, erva-mate (*Ilex paraguariensis*) is favored. This research aims to contribute to understanding of managed landscapes, traditional practices in the use of biodiversity and to promote a greater understanding of *caívas* role in the conservation of the Araucaria Forest landscape.

Keywords: local management, historical ecology, araucaria forest, caívas.

3.1. INTRODUCTION

It is a common ecological view to recognize some forests as primary or as natural pristine and untouched landscapes; however, many forests are more like gardens (Heckenberger, 2007), in the other words they are in constant use (Erickson, 2008; Clement & Junqueira, 2010). Forests are also sources of income and resources for many local populations, which depend directly on use of plant species (Alcorn, 2005). In many forests around the world, traditional communities are seen as fundamental for maintaining the richness in biological diversity, contributing to the maintenance of biodiversity and ecosystems (Alcorn, 2005).

The Atlantic Forest is one of the most threatened and profoundly fragmented biomes in Brazil, consisting in its majority of secondary forests (Pinto *et al*., 2009). The Brazilian Atlantic Forest once covered 1.3 million km^2, with an extension from northeast Brazil to the state of Rio Grande do Sul, and now it has lost around 85% of its original land cover. Beyond its relevance for conservation the Atlantic Forest is of great importance for the survival of human populations, considering indigenous populations as much as traditional and even urban populations (Pinto *et al*. 2009). The current landscape structure of the Atlantic Forest is complex and demonstrates many human influences in its functioning, structure and space, transforming a natural landscape into a cultural landscape (Oliveira, 2010).

The transformations of the landscape by humans have been the focus of ethnoecological and historical ecology approaches (Crumley, 1994; Balée, 2006). Historical ecology is a relatively new approach centered on landscape (Crumley, 1994; Lunt & Spooner, 2005; Balée, 2010). Within this perspective a landscape is understood as an anthropogenic environment, taking into consideration a co-adaptive point of view where humans have an effect on nature, as well as the

reciprocal, where the environment has an effect on human behavior and culture (Crumley 1994; Balée, 2006). An ethnoecological perspective seeks to understand the local ecological knowledge, but also ways in which groups of people perceive and interact with the ecosystems and environments where they live. In historical ecology and ethnoecology the concept of landscape transformation is distinguished from landscape ecology (Balée, 2006; Balée, 2010). Landscape ecology focuses on spatial heterogeneity reflected in ecosystems, and tends to take into account the disturbances as impacts of human interaction with the environment (Forman & Godron 1986; Crumley, 1994; Balée, 2006). Landscape ecology does not incorporate the local ecological knowledge and does not use the local knowledge for conservation of ecosystems, as well as how these can cause temporal changes (Balée, 2006). Historical Ecology is at odds with the view that human behavior has only transformed environments with high species richness into desolate landscapes of low diversity and high homogeneity (Balée, 2006; Heckenberger et al. 2007). Instead historical ecology postulates that humans have the ability in some cases to increase the diversity of local species through practices of natural resource management (Crumley, 1994; Winthrop, 1994; Heckenberger, 2007; Balée, 2010). Some approaches in ecology interpret these practices as always destructive, however, historical ecology focuses on contemporary ecological models (Balée, 2006), such as the nonequilibrium hypothesis (Connell, 1978; Huston, 1979).

Disturbances are considered a source of change in species composition within a location, and they often contribute to the maintenance of high biodiversity, by preventing one species from driving its competitors or prey to local extinction (Connell, 1978; Huston, 1979). A disturbance is defined as a process that removes biomass from a community (Hughes, 2012), and has an influence on species diversity and the maintenance of this diversity (Huston, 1979; Connell, 1978). Disturbances may be biotic or abiotic (Huston, 1979), as well as cultural and historical (Balée, 2006). In ecological studies there is evidence that disturbances (anthropic or natural) can influence community-level diversity (Connell, 1978; Huston, 1979; Bongers, 2009; Hughes, 2012). Connell (1978), working in tropical forests, found that in a forest community there is an optimum degree of disturbance that maximizes species diversity. Myers & Bazely (2003) introduced a simplified model of the intermediate disturbance hypothesis or nonequilibrium hypothesis, which also states that an intermediate level of disturbance will maximize species diversity (Connell, 1978; Huston

1979; Myers & Bazley, 2003; Hughes, 2012). In the case of this study an intermediate level of disturbance is considered an intermediate frequency of management practices within the landscape units, being that forest management practices are anthropogenic disturbances. The historical ecology perspective emphasizes that not every anthropic action leads to degradation, and that in fact, humans are an integral component of landscapes, and may work to maintain or maximize species diversity (Crumley, 1994; Lunt & Spooner, 2005; Balée, 2006; Rick & Lockwood, 2012).

In a historical ecology study in the Pacific Northwest of the United States, Winthrop (1994), found that economy and belief system account for significant differences in how people affect the environments in which they live. Furthermore she affirmed that cultural transformations also promote transformations in landscape, and a once previous lush environment used by the indigenous became a mining environment dominated by settler's culture, not just the indigenous culture. The same was observed in equatorial Africa by Schimdt (1994), that cultural, economic and belief systems greatly influence landscape transformations. In the Brazilian Amazon, many authors consider the Amazonian forests as a cultural artifact, that have been modified by indigenous peoples throughout time and is a remnant of these modifications (Posey, 2002; Balée, 2010).

In the Brazilian Atlantic Forest of southern Brazil another landscape is being transformed, the Araucaria Pine Forest. The Araucaria Pine Forest is characterized by the presence of the dominant tree species *Araucaria angustifolia* (Bertol.) Ktze (pinheiro) (IBGE, 2012). The Araucaria Forest has been heavily exploited in southern Brazil, resulting in fragmentation of this ecosystem, leaving forest remnants in several states of conservation. This exploitation has led to changes in the landscape, leading to structural and floristic changes (Carvalho, 2010; Brandt, 2012). Although most areas of Araucaria Forest have some degree of human disturbance, forests are highly relevant to the conservation of biodiversity. Forests are important for human populations who still depend on their environmental services and resources (Alcorn, 1995; Toledo & Barrera-Bassols, 2010).

The Araucaria Forest landscape has been transformed and modified since the end of the Holocene and has had a recent expansion to southern Brazil (Bittencourt & Krauspenhaur, 2006). Bittencourt & Krauspenhar (2006) argued that the expansion of the Araucaria Forest was benefited by indigenous groups of hunter-gatherers and through the

use of the *pinhão* (the araucaria's seed) as a food source, promoted the expansion of the forest.

Present-day local rural communities denominate some forest areas as *caívas*. Marques (2008) describes a *caíva* as "an ecosystem of native forest remnants, with different levels of forest density, where the herbaceous levels are made up of native and/or naturalized pastures, that are extensively pastured." Thus, *caívas* can be seen as ecotopes with Araucaria Forest tree layer and herbaceous layer made up of pastures, where animals are raised in conjunction with the management of erva-mate and other native tree species (Mattos, 2011; Mello, 2013, chapter 1 of this dissertation).

It is important to study the effect of humans on this fragmented landscape. These studies do not only inform conservation of natural resources in the Araucaria Forest but how traditional management systems have helped maintain these forest fragments, since most areas of this ecosystem are found on private rural properties (Marques et al., 2008; Hanisch, 2010; Mello, 2013, chapter 1 of this dissertation).

Therefore, the objective of this study is to understand how traditional populations have transformed their landscapes. More specifically, we aimed to characterize the ecotope *caíva* of the Araucaria Forest using etnoecological and ecological approaches, as well as to elucidate how the use of biodiversity in this ecotope can contribute to the forest conservation. We hypothesize that transformation in the Araucaria Forest landscape is due to management practices and that these practices have helped maintain or increase the richness and diversity of tree species.

3.2. MATERIALS & METHODS

3.2.1 STUDY AREA

This study was carried out in the Northern Plateau of the state of Santa Catarina in southern Brazil. The data was collected in two rural communities and the National Forest of Três Barras. The first community, Campininha, is located in the municipality of Três Barras (Figure 1) and was founded in the 19th Century by colonizers that received the territory from the government (Filippon, 2009; Mattos, 2011). The municipality is located at latitude 26º06'23"S and longitude 50º19'20"W, with an altitude of 802 meters. The area was mainly used to raise cattle, erva-mate extraction and logging. Campininha has about 50 households of farming families. There are various immigrant

ethnicities in the region, including Polish and a smaller number of Germans, Turkish, Italians and Lebanese.

The second community, Colônia Escada, is located in the municipality of Irineópolis (Figure 1). Caetano Valões founded the municipality in 1885 and in the 1920's immigrants of various descents, such as German, Polish, Ukrainian, and to a lesser extent Italian, began to colonize this community's region. The municipality is located at latitude 26º14'19" S and longitude 50º47'59"W, with an altitude of 762 meters.

Both communities are located near urban areas. Campininha is located near the city of Canoinhas and Três Barras. Colônia Escada is located near the city of Irineópolis. The primary source of income for people of Colônia Escada and Campininha is agriculture.

The study was also conducted in the National Forest of Três Barras (Figure 1), which is located in the state of Santa Catarina, Brazil (geographic coordinates: between the latitudes of 26°10'S & 26°15'S and longitudes of 50°10'W & 50°15'W) (Corrêa *et al*. 2008). The FLONA was used as a control area, where the Araucaria Forest has not been managed over the past 70 years. The FLONA has an area of 4458.5 hectares with an altitude ranging between 700 and 800m. The climate is characterized as humid subtropical or cfb according to the Koppen-Geiger classification (Corrêa *et al*. 2008; IBAMA, 2012). Before becoming conservation unit the area was used for the production of cedro (*Cedrela fissilis* Vell.) and araucaria pine (*Araucaria angustifolia*), managed by the National Pine Institute (INP), after which the area became a conservation unit under responsability of the the Brazilian Institute for Forest Development (IBDF) (IBAMA, 2012). Currently the FLONA is managed by the Chico Mendes Institute for Biodiversity Conservation (ICMBio), and is classified as a federal sustainable use conservation unit according to the National System of Nature Conservation Units (SNUC) (IBAMA, 2012). The FLONA's primary goal is support research and sustainable use of forest resources, as well as nature conservation (IBAMA, 2012).

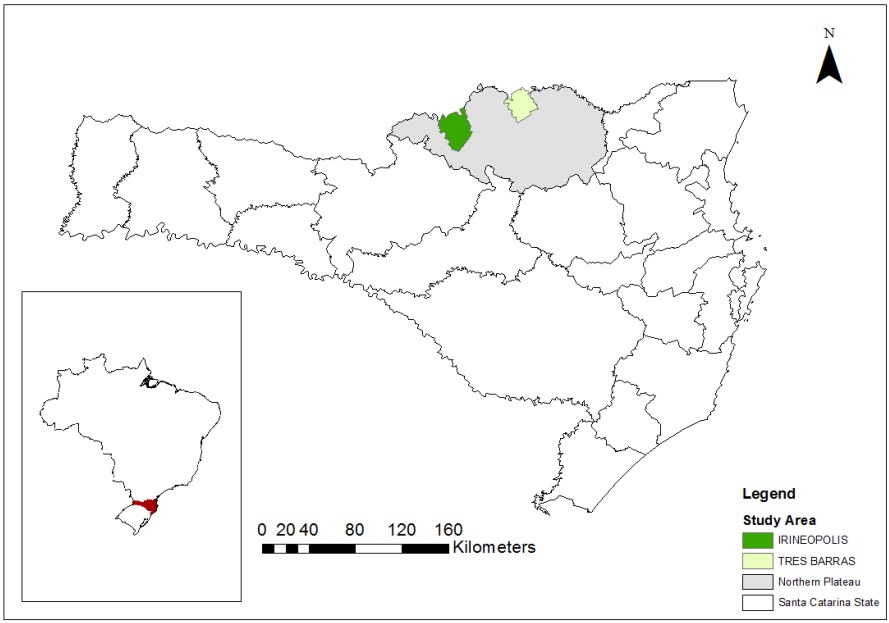


Figure 1. Study area in the Northern Plateau of the state of Santa Catarina. The community of Campininha and the National Forest are located in the municipality of Três Barras. The community of Colônia Escada is located in the municipality of Irineopolis. (Constructed using the program ArcGis by Juan Manuel Otalora and Anna Jacinta Machado Mello).

3.2.2 INFORMANT SELECTION AND INTERVIEWS

In total six informants consented to participate in this part of the project from both communities. Each property owner was interviewed for basic information on their property and asked to identify and name the ecotopes where eventually the permanent plots would be set up for a phytosocilogical survey. Informants chose the ecotopes and areas. Each informant was interviewed in 2008[4] regarding ecotopes existent on their

[4] Conservabio was responsible for the interviews and phytosociological study conducted in 2008. It is a project conducted during 2008-2010. The project Conservabio was done through partnerships between the Núcleo de Pesquisas em Floresta Tropicais (NPFT) at Federal University of Santa Catarina, Embrapa (Brazilian Company for Agricultural Research), EPAGRI (Company for Agricultural Research and Rural Extension in Santa Catarina) and ICMBio (Chico Mendes Institute for Biodiversity Conservation). For more information please see Peroni *et al*. 2009 and Boef *et al*. 2013.

property, management practices exerted within the ecotopes. A second round of interviews was conducted in 2012 in order to access more specific information regarding the ecotopes, the main management practices and frequency of management practices.

Informants identified 10 ecotopes within their properties. The National Forest of Três Barras, ecotope number 11, was used as an area of natural succession, since there has been no human management in the area for the past 70 years (Table 1). Table 1 provides a detailed description of each of the ten ecotopes, with the number of plots within each ecotope, the local name given to each ecotope, and the description of the type of management and forest structure contained on the farmer's property (Mattos, 2011).

Before beginning the study a prior informed consent was conducted (Appendix 2), which explained the objectives and nature of the study, and probable outcomes to each informant, in accordance with the code of ethics of the International Society of Ethnobiology and Provisional Measure: MP n° 2.186-16 (23/08/2001) (Álvares, 2005; ISE, 2006). The ethics committee of the Federal University of Santa Catarina approved the study with the CAAE number of: 01262212.5.0000.0121.

3.2.3 PHYTOSOCIOLOGICAL SURVEY

A phytosociological survey has as its objective to quantify the floristic composition, structure, functioning, dynamics and distribution of specific vegetation (Longhi, 2000; Felfili et al., 2011) and was conducted to evaluate the tree community in the Araucaria Forest ecotopes within rural properties and in the National Forest of Três Barras. These data was analyzed considering the local ecological knowledge on management practices and historical use of natural resources to inform landscape transformations. The survey was conducted between July 2008 and November 2010 for the project Conservabio.

The survey was carried out in permanent plots of 1600m^2 (40x40 m) subdivided into smaller plots of 100 m^2 (10x10m) with 50m between each plot based on previous studies. For each ecotope there were one to three plots within the rural property (Table 1). Within each plot all individuals above 1.5 m in height were identified, the height was estimated and diameter at breast height (dbh=1,30m) was measured with a forest caliper. No minimum dbh was used to assess the individual trees inclusion in the survey, only a minimum height. Each individual was marked with an aluminum tag containing the plot, subplot and individual

number, after which each individual was mapped in (x,y) meters coordinates. Individuals of species, which were not identified in the field, were collected for taxonomic identification and were deposited in the herbarium FLOR in the Federal University of Santa Catarina (Brazil). Twenty plots were established in the community of Campininha and five in the community of Colônia Escada and three permanent plots were installed in the FLONA. A second survey was completed in 2011, within the same permanent plots in order to identify species, which were not previously identified in 2008. Data from 2011 was integrated with data from the previous survey. The collection of plant material was approved by the Chico Mendes Institute for Biodiversity Conservation (ICMBio/MMA) and the System of Authorization and Information of Biodiversity (SISBIO) emitted on January 7th 2012 (case number: 32055-1).

3.2.4 DATA ANALYSIS:

The interviews data were utilized to obtain descriptions of each ecotope, as well as descriptions of management category and frequencies. These data were placed into tables along with other quantitative data regarding the ecotope.

The structural and floristic similarities between ecotope was evaluated using phytosociological parameters: number of species, number of families, number of individuals (N), absolute and relative frequency (FA & FR), absolute and relative density (DA & DR), absolute and relative dominance (DoA & DoR), and importance value index (IVI) (Felfili *et al*., 2011).

To compare ecotopes in terms of species diversity and richness, Shannon-Weiner diversity index (H'), and Hurlbert (PIE) diversity index were calculated using the program *EcoSim 700 (Null Modeling Software for Ecologists)* (Entsminger, 2012). The Shannon-Weiner diversity index (H'), ranges between zero to five but generally for communities H' ranges from 1.5 to 3.5 (Magurran, 2004; Khan, 2006). Hurlbert's index (PIE) ranges between zero and one, and shows the probability that two randomly sampled individuals from the community represent two different species (Hurlbert, 1971).

Multivariate analysis was used to compare species composition of each ecotope with landscape management practices. The similarity of species composition and abundance between different managed ecotopes was calculated through a Bray-Curtis similarity index and a cluster analysis using the UPGMA algorithm method

(Unweighted Pair Group Method with Arithmetic Mean) (Legendre & Legendre 2012). Prior to the analysis the species abundance data was transformed using log10 in order to reduce the importance of extreme values.

An ADONIS, a multivariate analysis that partitions sum of squares using semimetric or metric distance matrices, also referred to as permutational manova, or a multivariate ANOVA based on dissimilarities (Borcard *et al*. 2011), was used to test the similarities between ecotopes based in the different management categories carried out within each ecotope. The statistical test ADONIS included four main management categories, named simply as: "cattle", "herbaceous", "cerninho" and "erva-mate" (Table 2). The four management categories were chosen from the interview conducted with each participant. Each management category was considered a disturbance to the forest ecosystem, and classified by frequency of the disturbance, since these kind of managements have influence in the species diversity and abundance by favoring some over others. Frequency of management categories (disturbance) was classified from 0 to 3 for each ecotope. The classification was as followed: 0 as nonexistent – is not carried out within the ecotope; 1 as low frequency – management is carried out every three to five years; 2 as intermediate frequency – management is carried out every two years; 3 as intensive frequency – management is carried out monthly or yearly. This classification system was based on answers from interviews conducted with farmers about the frequency of management in their *caívas*. Table 2 provides the results to the interview and the organization of the classification system. The classification system was designed by the authors to better enable multivariate analysis. For example: the management intensity was then used as a factor to compare species composition and abundance within and between each ecotope. The ADONIS partitions dissimilarities for the sources of variation, and uses Monte-carlo permutation tests to inspect the significances of those partitions (Oksanen, 2012). All multivariate analysis were performed using the R-Project 2.15.2. (R Core Team, 2011). It was calculated the relative abundance number for each ecotope since there were different number of plots in each ecotope.

Table 1. Descriptions of ecotopes in the communities of Campininha, Colônia Escada and National Forest of Três Barras, Santa Catarina, Brazil. (Modified from *Mattos, 2011*).

Location	Informant	Ecotope Number	Number of plots	Name given to ecotope by farmer	Description of ecotope and management practices
Campininha	A	1	3	Barbaquá	Dense area, many araucaria individuals. Constant removal of cerninho.
		2	3	Taquaral	Open area, 30 years before was a bamboo thicket. With the loss of the bamboo thicket there is a high density of *erva-mate* with little diversity. Constant presence of cattle. Herbaceous layer is regularly removed.
		3	1	Campo	Open area, small number of species, high abundance of *erva-mate*. Constant presence of cattle.
		4	2	*Caíva* A	Open area, Araucaria shade and regular cattle presence. Herbaceous layer is regularly removed. Constant removal of cerninho.
Campininha	B	5	2	*Caíva* B	Open area, Araucaria shade and regular cattle presence. Herbaceous layer is regularly removed. Constant removal of cerninho.
		6	3	Mato Fechado	Dense area with denser vegetation. Intermediate presence of cattle. Constant removal of cerninho.
Campininha	C	7	3	*Caíva* C	Open area. Trimming and cleaning of the herbaceous layer is done often, and animal presence. The area has been used for 50 years. Intermediate removal of cerninho.

Colônia Escada	D	8	2	Mato	Dense area. High diversity of species in high quantities. Presence of cattle.
Colônia Escada	E	9	1	*Caíva* D	Dense area. Little access by animals. Little extraction of erva-mate. Located by a river. Intermediate removal of cerninho.
Colônia Escada	F	10	2	*Caíva* E	Very dense area with lots of shade. High diversity of species. Some removal of cerninho.
National Forest of Três Barras	G	11	3	FLONA	Very dense area with lots of shade. High diversity of species.
TOTAL	7	11	25		

Table 2. Four most common management categories and their frequency in Araucaria Forest ecotopes in the communities of Campininha and Colônia Escada, Santa Catarina, Brazil. 0 as nonexistent – is not carried out within the ecotope; 1 as low frequency – management is carried out every three to five years; 2 as intermediate frequency – management is carried out every two years; 3 as intensive frequency – management is carried out monthly or yearly.

Management category	Description	Taquaral	Barbaqua	Campo	*Caíva* A	*Caíva* B	*Caíva* C	*Caíva* D	*Caíva* E	Mato	Mato Fechado	FLONA
Erva-mate	Pruning erva-mate with a machete or scissors, or breaking by hand to collect leaves	2	2	2	1	2	2	1	1	1	0	0
Cattle	Maintain cattle within caíva to clean herbaceous layer and feed on native pastures. Between 5 – 20 heads of cattle grazing.	3	3	3	2	3	3	2	0	2	1	0
Herbaceous	Removal of herbaceous layer with a scythe, tractor or weed cutter.	3	3	3	2	3	3	3	2	1	1	0
Cerninho	Pruning the species cerninho (*Curitiba prismatica*) with machete, scythe or scissors to reduce size.	3	3	0	2	3	2	1	0	0	0	0

3. RESULTS

3.3.1 MANAGEMENT PRACTICES IN ECOTOPES

The primary activity of all households is agriculture and cattle raising. According to informants, the primary crops planted are corn, beans, tobacco, and soybeans. In the wintertime pastures for livestock are planted, which include ryegrass and oats. Some families depend on the extraction of erva-mate to supplement their income. In Campininha, the average size of properties is 25.4 hectares (ha), ranging from 16 ha to 33 ha. In Colônia Escada, the average size of the properties is 19.5 ha, ranging from 3.25 ha to 33 ha.

Four informants viewed their forests as one type of ecotope, labeling the entire property with one name and describing the same management throughout. Two farmers separated their forest areas into various ecotopes depending on current and historical use and management categories of the area (Table 2). There were four main management categories exercised within each ecotope, which are the extraction of erva-mate, removal of the herbaceous layer, raising cattle under the forest understory, and removal of the woody species cerninho (*Curitiba prismatica* (D.Legrand) Salywon & Landrum) (Table 2).

According to all six informants, the first most common management category, is the gathering of erva-mate, which is done yearly in different areas, with a two to three year pause in gathering of each area (this category is entitled erva-mate in analysis). The removal of the herbaceous layer, also according to all informants, was the second most common management category, which facilitates the growth and gathering of erva-mate within the forest area ((this category is entitled herbaceous in analysis). Furthermore, the removal of the herbaceous layer also facilitates access to native pasture by the cattle. The third most common management category is the presence of cattle in the understory of the Araucaria Forest (this category is entitled cattle in analysis). All informants raise cattle within the forest areas and during the summer, spring and fall the cattle feed on the native pasture in the area of *caíva*. Cattle also serve the purpose of cleaning the *caíva* to maintain better access to erva-mate. In the wintertime all informants said their cattle are fed winter pastures, such as ryegrass, which are grown in the area of cultivation. Lastly, the fourth most common management category is the removal of the species cerninho, which considered a pest in forest areas since it is a fast growing tree shrub and is densely found in some areas of the Araucaria Forest (this category is entitled cerninho

in analysis) (Mello, 2013, dissertation).

3.3.2 ECOTOPE STRUCTURE, COMPOSITION, RICHNESS AND DIVERSITY

For each ecotope a phytosociological table was generated which depicts the parameters. Table 3 summarizes all phytosociological data for each of the eleven ecotopes and includes a detailed description provided by the informants, and information from phytosociological data which includes: the number of species, number of taxonomic families, most abundant taxonomic families, top three most abundant species, species with the greatest relative density, greatest relative dominance and greatest importance value. Appendix 4 contains all the phytosociological information from each ecotope with all the species data. Figure 2a-k exemplifies each of the ecotopes of this study. Appendix 5 shows all the species found within the ecotopes of the Araucaria Forests organized by botanical family and showing their absence or presence within each ecotope. In total 11,997 plants were collected corresponding to 166 species.

There are several ecotopes which landowners called *caívas*, these are cultural ecotopes Araucaria Forest with traditional management practices, which may promote the conservation of natural resources present within this ecosystem (Mello, 2013 chapter 1 of this dissertation). Each *caíva* belongs to a different farmer and are found in different forest areas. Some other ecotopes have more intense managements than the *caívas*, and others were previously used as *caívas* but the use of these areas was discontinued due to Brazilian environmental legislation.

Only two species appear in all the ecotopes (Appendix 4&5), the *Araucaria angustifolia* (araucaria) and *Ilex paraguariensis* (erva-mate). A third species, *Curitiba prismatica* (cerninho) also appears in all ecotopes with the exception of the campo ecotope. These three species also dominate the top three places in importance index for almost all ecotopes (Table 3). The araucaria has the largest relative dominance in six out of eleven ecotopes, and second largest relative dominance in another two ecotopes. The erva-mate has the greatest abundance and relative density in six out of eleven ecotopes. Other species with large relative dominance or density are *Curitiba prismatica* (cerninho), *Rhamnus sphaerosperma* (cangica), *Acca sellowiana* (goiaba da serra), *Zanthoxylum fagara* (mamica-de-cadela), *Drimys brasiliensis* (cataia), *Matayba elaegnoides* (camboatá), *Ocotea porosa* (imbuia),

Vernonanthura discolor (vassourão), *Ocotea puberula* (canela), *Prunus myrtifolia* (pessegueiro-bravo), *Cinnamomum amoenum* (canela), *Jacaranda puberula* (caroba), *Myrcia splendens* (guamirim), *Casearia sylvestris* (guaçatonga), *Campomanesia rhombea* (guavirova), and *Ilex brevicuspis* (caúna) (Table 3).

However despite their dominance the species *Ilex paraguariensis* (erva-mate) has the highest importance value index (IVI) in five ecotopes, and *Araucaria angustifolia* has the highest importance index value in four ecotopes, and *Curitiba prismatica* and *Prunus myrtifolia* each in one ecotope. In some ecotopes *Ilex paraguariensis* has an IVI eleven times greater than the second placed species, which is the case for the campo ecotope, and in other ecotopes five times greater, such as the taquaral ecotope (Table 3).

Rare species within the ecotopes included four *Myrcia* spp from the Myrtaceae family, three *Piptocarpha* spp from the Asteraceae family, two *Ilex* spp from the Aquifoliaceae family, two *Casearia* spp from the Salicaceae family, two *Ocotea* spp from the Lauraceae family, two *Miconia* spp from the Melastomataceae family, *Mimosa scabrella* (bracatinga), and *Maytenus ilicifolia* (espinheira-santa) (Appendix 4).

Table 3. Summary of phytosociological data for each ecotope found in the communities of Campininha, Colônia Escada, and in the National Forest of Três Barras, Santa Catarina, Brazil, which includes a description, the number of species (N), number of taxonomic families (Ntf), most abundant taxonomic families, top three most abundant species, greatest relative dominance and greatest importance value.

Ecotope	Description	N	N_{tf}	Most abundant Tax. Fam.	Greatest Species Abundance	Greatest Relative Dominance	Greatest Importance Value Index
Barbaqua	Historically a space used to prepare erva-mate. A dense area with many individuals of *Araucaria angustifolia*. There is little cattle presence. There is a large abundance of erva-mate. The species cerninho is removed every year in order to make room for the erva-mate.	38	22	Lauraceae (7) Myrtaceae (6) Aquifoliaceae (3)	1. *Ilex paraguariensis* **(186)** 2. *Curitiba prismatica* **(29)** 3. *Araucaria angustifolia* **(28)**	1. *Araucaria angustifolia* **(28.34)** 2. *Ilex paraguariensis* **(24.85)** 3. *Curitiba prismatica* **(5.5)**	1. *Ilex paraguariensis* **(78.6)** 2. *Araucaria angustifolia* **(36.53)** 3. *Curitiba prismatica* **(13.97)**
Taquaral	An open area. Thirty years ago the area was a bamboo thicket. The area has little diversity but a high abundance of erva-mate, which was favored by the property owners. There is constant presence of cattle, the herbaceous layer is removed, since it is an open area the species cerninho is not as abundant but still is removed	26	17	Aquifoliaceae (3) Asteraceae (3) Myrtaceae (3)	*1. Ilex paraguariensis* **(558.33)** 2. *Araucaria angustifolia* **(31.25)** 3. *Acca sellowiana* **(10.42)**	*1. Ilex paraguariensis* **(47.73)** 2. *Araucaria angustifolia* **(18.50)** 3. *Acca sellowiana* **(5.4)**	1. *Ilex paraguariensis* **(125.30)** 2. *Araucaria angustifolia* **(22.90)** 3. *Acca sellowiana* **(6.91)**

Campo	The ecotope *Campo* refers to a large field comprised solely of *Ilex paraguariensis*, with only four other identified species. This was previously an area of Araucaria Forest but was slowly removed in order to grow erva-mate. This area has a constant presence of cattle.	5	5	Aquifoliaceae (1) Araucariaceae (1) Winteraceae (1) Fabaceae (1) Rhamnaceae (1)	1. *Ilex paraguariensis* **(324)** 2. *Rhamnus sphaerosperma* **(7)** 3. *Araucaria angustifolia* **(1)**	1. *Ilex paraguariensis* **(71.41)** 2. *Araucaria angustifolia* **(14.95)** 3. *Drimys brasiliensis* **(6.28)**	1. *Ilex paraguariensis* **(168.29)** 2. *Araucaria angustifolia* **(15.42)** 3. *Drimys brasiliensis* **(6.74)**
***Caíva* A**	An open area, with many Araucaria individuals, regular cattle presence and the herbaceous layer that is regularly removed. The species cerninho is also trimmed or removed yearly. This area is a traditional area of caíva.	29	20	Solonaceae (3) Aquifoliaceae (2) Asteraceae (2) Anacardiacea Salicaceae (2)	1. *Ilex paraguariensis* **(94)** 2. *Araucaria angustifolia* **(30)** 3. *Rhamnus sphaerosperma* **(13)**	1. *Araucaria angustifolia* **(51.97)** 2. *Ilex paraguariensis* **(7.67)** 3. *Matayba elaegnoides* **(6.90)**	1. *Araucaria angustifolia* **(67.26)** 2. *Ilex paraguariensis* **(55.44)** 3. *Matayba elaegnoides* **(8.44)**
***Caíva* B**	An open area, with many Araucaria individuals, regular cattle presence and herbaceous layer that is regularly removed. The species cerninho is also removed yearly. This area is considered a traditional area of caíva.	41	23	Myrtaceae (8) Aquifoliaceae (4) Asteraceae (3) Sapindaceae (3)	1. *Araucaria angustifolia* **(102)** 2. *Ilex paraguariensis* **(45)** 3. *Curitiba prismatica* **(28)**	1. *Araucaria angustifolia* **(76.93)** 2. *Ilex paraguariensis* **(3.35)** 3. *Curitiba prismatica* **(2.20)**	1. *Araucaria angustifolia* **(111.9)** 2. *Ilex paraguariensis* **(18.76)** 3. *Curitiba prismatica* **(11.82)**

***Caíva* C**	An open area, with constant cattle presence. The herbaceous layer and cerninho are removed yearly. This area is considered a traditional area of caíva and has been used for over 50 years.	61	26	Lauraceae (10) Myrtaceae (9) Fabaceae (5) Salicaceae (5)	1. *Ilex paraguariensis* **(135)** 2. *Curitiba prismatica* **(43)** 3. *Matayba elaegnoides* **(32)**	1. *Matayba elaegnoides* **(18.53)** 2. *Vernonanthura discolor* **(12.80)** 3. *Ocotea porosa* **(12.70)**	1. *Ilex paraguariensis* **(32.70)** 2. *Matayba elaegnoides* **(25.53)** 3.*Vernonanthura discolor* **(15.66)**
***Caíva* D**	A dense area, with little cattle presence. The herbaceous layer and cerninho are removed intermediately. The area is located by a river and is considered a traditional area of caíva, where erva-mate is also extracted.	59	27	Lauraceae (6) Myrtaceae (6) Aquifoliaceae (5) Asteraceae (5) Solonaceae (5)	1. *Ilex paraguariensis* **(537)** 2. *Matayba elaegnoides* **(77)** 3. *Zanthoxylum fagara* **(29)**	1. *Matayba elaegnoides* **(20.02)** 2. *Ilex paraguariensis* **(15.51)** 3. *Ocotea puberula* **(12.55)**	1. *Ilex paraguariensis* **(72.59)** 2. *Matayba elaegnoides* **(28.21)** 3. *Ocotea puberula* **(13.42)**
***Caíva* E**	A very dense area, with cattle presence. The herbaceous layer is removed intermediately, and the species cerninho is not removed. This area is considered a traditional area of caíva, where erva-mate is also extracted.	70	32	Myrtaceae (11) Lauraceae (6) Salicaceae (4) Melastomataceae(4)	1. *Curitiba prismatica* **(719)** 2. *Araucaria angustifolia* **(272)** 3. *Myrcia splendens* **(171)**	1. *Araucaria angustifolia* **(32.56)** 2. *Curitiba prismatica* **(17.10)** 3. *Ilex paraguariensis* **(8.41)**	1. *Curitiba prismatica* **(52.16)** 2. *Araucaria angustifolia* **(45.83)** 3. *Myrcia splendens* **(13.78)**

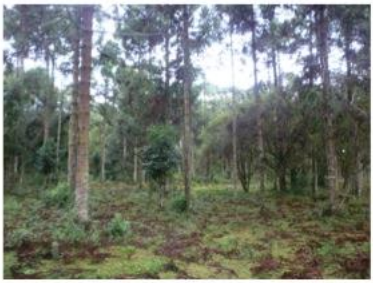
Mato	A dense area, with intermediate cattle presence, and a large diversity of species. This area was historically considered a traditional area of *caíva*, however due to legal restrictions of forest use the property owners discontinued use of the resources within this area, therefore they now name it "mato", which stands for "forest". The use of the area was discontinued eight years ago.	86	33	Myrtaceae (15) Lauraceae (13) Solonaceae (6)	1. *Curitiba prismatica* **(348)** 2. *Ilex paraguariensis* **(305)** 3.*Casearia sylvestris* **(222)**	1. *Prunus myrtifolia* **(22.65)** 2. *Cinnamomum amoenum* **(13.78)** 3. *Vernonanthura discolor* **(8.77)**	1. *Prunus myrtifolia* **(27.36)** 2. *Curitiba prismatica* **(21.77)** 3.*Cinnamomum amoenum* **(17.18)**
Mato Fechado	A dense area, with dense vegetation, and intermediate cattle presence. The species cerninho is removed from the area. This area is considered a traditional area of caíva.	88	33	Myrtaceae (13) Lauraceae (10) Asteraceae (7)	1. *Curitiba prismatica* **(517)** 2. *Araucaria angustifolia* **(170)** 3. *Campomanesia rhombea* **(156)**	1. *Araucaria angustifolia* **(34.01)** 2. *Matayba elaegnoides* **(13.07)** 3. *Curitiba prismatica* **(9.88)**	1. *Araucaria angustifolia* **(42.11)** 2. *Curitiba prismatica* **(34.49)** 3. *Matayba elaegnoides* **(18.51)**
FLONA	A very dense area, with no forest management for the past 70 years.	70	32	Myrtaceae (8) Lauraceae (8) Aquifoliaceae (4)	1.*Vernonanthura discolor* **(1882)** 2. *Ilex paraguariensis* **(427)** 3. *Ilex brevicuspis* **(184)**	1. *Araucaria angustifolia* **(21.40)** 2.*Vernonanthura discolor* **(8.04)** 3. *Jacaranda puberula* **(4.62)**	1. *Araucaria angustifolia* **(67.06)** 2.*Vernonanthura discolor* **(48.21)** 3. *Ilex paraguariensis* **(15.38)**

a) Barbaquá

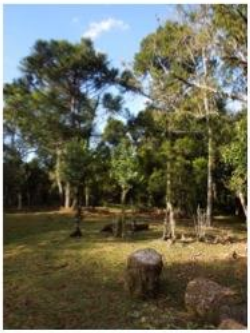
b) Taquaral

c) Campo

d) Caiva A



e) Caiva B



f) Caiva C

g) Caiva D

h) Caiva E

i) Mato

j) Mato Fechado

k) FLONA

Figure 2a-k. Aspects of the ecotopes from the Araucaria Forest of the northern plateau of Santa Catarina in the communities of Campininha, Colonia Escada and in the National Forest of Três Barras, Santa Catarina, Brazil. a) Barbaquá; b) Taquaral; c) Campo; d) *Caíva* A; e) *Caíva* B; f) *Caíva* C; g) *Caíva* D; h) *Caíva* E; i) Mato; j) Mato Fechado; k) FLONA.

Table 4 shows the Shannon-Weiner diversity index, Hurlbert's diversity index (PIE) and species richness for all ecotopes. The species richness represented in the table is a relative species count present in each ecotope. Table 4 shows a higher H' for the ecotopes *Mato* (2.91), *Mato Fechado* (3.10), *Caíva* B (2.25), *Caíva* C (2.49), *Caíva* E (2.61) and FLONA (2.30). The ecotopes with a lower H' are *Barbaqua* (1.53), *Caíva* A (1.70), *Taquaral* (0.66), Campo (0.18), and *Caíva* D (2.12). The same is true for species richness. A high PIE (probabilistic interspecific encounters) value signifies a greater probability of encountering individuals of the same species within the plant community. Values of PIE that are small demonstrate less dominance of a specific species and more evenness in species distribution, which was the case for the ecotopes: *Caíva* B (0.19), *Caíva* C (0.15), *Caíva* E

(0.16), FLONA (0.21), Mato (0.09) and Mato Fechado (0.09). The other ecotopes, Barbaqua (0.39), Campo (0.94), *Caíva* A (0.32), *Caíva* D (0.34) and Taquaral (0.73), had high probability of interspecific encounters, therefore a less even distribution of species. The two ecotopes with the highest species richness, lowest PIE and highest diversity were *Mato Fechado* and *Mato*, which were considered intermediately managed areas. The intermediately managed ecotopes show an increased diversity and richness when compared to areas of National Forest and areas of intense management.

Table 4. Shannon-Weiner and Hurlbert diversity index (H') and numerical species richness for eleven ecotopes of the Araucaria Forest found in the communities of Campininha, Três Barras and Colônia Escada, Irineópolis, and in the National Forest of Três Barras, Três Barras, Santa Catarina, Brazil.

Ecotope	H'	PIE	Richness
Barbaqua	1.53	0.39	39
Campo	0.18	0.94	6
Caíva A	1.70	0.32	30
Caíva B	2.25	0.19	42
Caíva C	2.49	0.15	62
Caíva D	2.12	0.34	60
Caíva E	2.61	0.16	71
FLONA	2.30	0.21	74
Mato	2.91	0.09	87
Mato Fechado	3.10	0.09	89
Taquaral	0.66	0.73	27

In a cluster analysis method three distinct groups of ecotopes were observed considering a similarity of 0.75 (Figure 3). The first group only contains the ecotope *Campo*. The second group contains the FLONA, *Caíva* D, *Caíva* E, *Mato* and *Mato Fechado*. The third group contains *Taquaral*, *Caíva* A, *Barbaqua*, *Caíva* C and *Caíva* B. The first group is different than all other groups in composition, since it only contains one dominant species, and five other species of little abundance. The second group contains the National Forest, a conservation area, two areas of *Caívas*, and two areas known as *Mato*

and *Mato Fechado*, both are areas of medium intensity forest management, all with high diversity and species richness. These ecotopes were found to be similar in species composition and abundance. The third group contained three ecotopes from one property and two *caívas* (B and C) from within the same community.

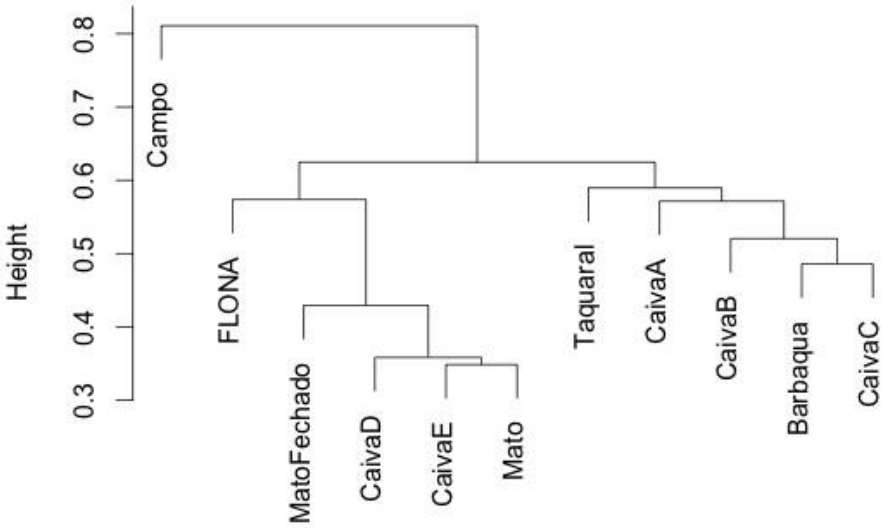


Figure 3. Cluster analysis using the UPGMA (r=0.796) method for eleven ecotopes of the Araucaria Forest found in the communities of Campininha, Três Barras and Colônia Escada, Irineopolis, and in the National Forest of Três Barras, Três Barras, Santa Catarina, Brazil.

The ADONIS showed that each management categories alone was significant in the dissimilarities of abundance and species composition of each ecotope. Each of the four management categories influenced the species abundance and composition (Table 5). The analysis also shows that management practices in conjunction could also explain the differences in abundance and composition between ecotopes, for example, the removal of cerninho (*Curitiba prismatica*) in conjunction with the extraction of erva-mate, for other management practices interactions see Table 5. Two interactions were not significant, which were the management practice of removing cerninho and raising cattle, and the interaction between removing the herbaceous layer and raising cattle. The removal of cerninho and herbaceous layer have the

same goal since the cerninho is often removed with the herbaceous layer, their interaction with cattle may be non-significant because cattle are used to keep the ecotopes clean and also remove biomass. This result exemplifies the anthropogenic influence over species composition and abundance.

Table 5. ADONIS comparing the affects of different management categories in relation to species composition and abundance in different ecotopes of the Araucaria Forest, in Campininha, Colonia Escada, and National Forest of Três Barras, Santa Catarina, Brasil. Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

Management categories	Df	Sum of Squares	F. Model	R2	Pr(>F)
Cattle	1	0.5894	2.432	0.2123	0.029*
Herbaceous	1	0.3319	2.203	0.1198	0.025*
Erva-mate	1	0.7421	3.293	0.2679	0.008**
Cerninho	1	0.6809	4.521	0.2458	0.002**
Cerninho:Erva-mate	1	0.4244	2.228	0.1532	0.048*
Cerninho:Herbaceous	1	0.4244	2.818	0.1532	0.017*
Cattle:Erva-mate	1	0.4511	2.684	0.1628	0.029*
Herbaceous:Erva-mate	1	0.4297	2.853	0.1551	0.002**
Cerninho:Cattle	1	0.1831	0.7982	0.0661	0.548
Herbaceous:Cattle	1	0.0987	0.4911	0.0356	0.871

3.4. DISCUSSION

Many tropical and subtropical forests have undergone changes due to human intervention. The study of these forest changes can be through the perspective of historical ecology. Historical ecology traces the dialectical relationships between human behavior and nature, which is thus manifested in the landscape (Crumley, 1994; Balée, 1998). In the northern plateau of Santa Catarina the Araucaria Forests have also undergone human intervention, through a dialectical relationship. The people of the communities of Campininha and Colônia Escada have transformed their landscapes, through use of natural resources to meet their economic and cultural needs. The erva-mate (*Ilex paraguariensis*)

is an example of such a transformation. In this study the erva-mate is the most abundant species in almost all the 11 landscape units, even that of the National Forest (Appendix 4). The erva-mate is culturally important for the communities of the northern plateau, not only does it provide economic support, it is the principal ingredient in *chimmarão*, a cultural drink, which is shared amongst friends, family and visitors. Mattos (2011) studying erva-mate in the northern plateau within these same communities found that almost all informants favor erva-mate within their property to be able to commercialize and provide the family with extra income. In this study it is clear that the Araucaria Forest in this ecotopes has been dominated by *Ilex paraguariensis*. In fact the most important management practice is the gathering of this species, and almost all other managements are done in function of favoring this species in the forested areas inside the farm properties (Mello, 2013, chapter one of this dissertation). The gathering of native erva-mate is an activity with low environmental impact, since the species is not removed but trimmed for its leaves, and the species is well adapted to shaded areas. Interestingly, erva-mate was found abundantly in the National Forest landscape. The National Forest was an area, which contained human management seventy years ago, shows some signs of past management, more specifically the high abundance of the species *Ilex paraguariensis*. Much of the National Forest, which comprise areas of Araucaria Forests, were previous farming lands and private properties which were donated during the course of time to the INP and IBDF (IBAMA, 2012)

The second most abundant and dominant species is the *Araucaria angustifolia*. Assis *et al*. (2010) found that both the araucaria and erva-mate are cultural keystone species for the local populations in the south of the northern plateau of Santa Catarina. The araucaria was highly exploited during the early 1900's by a North American company named Southern Brazil Lumber and Colonization Company that exploited the araucaria along with *Ocotea porosa* (imbúia), another large dominant timber species in southern Brazil (Carvalho & Nodari, 2008; Carvalho, 2010). Both species are now found on the endangered species list (IUCN).

The araucaria stands out in the ecosystem for being the largest tree, which can reach up to 50 meters in height and 2 meters in diameter (Reitz & Klein, 1966). The araucaria was considered a potential source of income and economic stability, since most people built their houses using this species and their children's inheritance was based on how many araucaria's dominated the property (Mello, 2013, chapter 1 of this

dissertation). Furthermore there is evidence that various indigenous groups in southern Brazil have managed the araucaria since the Holocene and that their territories depended on the existence of the araucaria. In actuality before colonization of southern Brazilian plateaus the land was dominated by the indigenous Gê groups Xokleng and Kaíngang, who were responsible for the species expansion, which is associated with "pit houses" of the indigenous populations (Bitencourt & Krauspenhar, 2006).

The araucaria has importance as a timber product but also a non-timber forest product, since most people extract the araucaria's seed (*pinhão*) as a food source. There are even cultural parties within the Campininha community in honor of the *pinhão*.

The third species, which stood out as dominant and abundant in many ecotopes in the phytosociological data, is the cerninho (*Curitiba prismatica*). The *C*. *prismatica* is endemic to the Atlantic Forest, and belongs to the Myrtaceae family. Most of the farmer's state that they remove this species because it grows fast and the leaves expand to take up large areas, which interfere with other species growth, especially that of *Ilex paraguariensis* (Mello, 2013, chapter 1 of this dissertation). This suggests that the cerninho is not as important culturally but makes up a large part of the Araucaria Forest ecosystem. This also displays a favoring of certain species over others, in this case *Ilex paraguarensis* over herbaceous species and the arbustive species cerninho.

Other species that had high importance values in different landscapes were *Acca sellowiana* (pineapple guava), *Matayba elaegnoides* (camboata), *Vernonanthura discolor* (vassourão-branco), *Prunus myrtifolia* (pessegueiro-bravo), *Cinnamomum amoenum* (canela-alho), and *Ocotea puberula* (canela-guiaca). The two canela species were historically used as timber resources and belong to the Lauraceae family, they are now in endangered species, therefore no use is permitted. (Mello, 2013, chapter 1 of this dissertation). The species pineapple guava is a Myrtaceae and is an important fruit species. Camboata, vassourão, and pessegueiro-bravo are species used as firewood.

Different ecotopes named and recognized as *caíva* showed different structures and compositions. The ecotopes are managed in accordance with the needs and experience of its property owners. Therefore no one ecotope is the same. These differences in structure and composition could be a result of management practices that the landscape has suffered over time (Crumley, 1994; Balée, 2006). The different management practices exerted on the Araucaria Forest have

had caused profound changes to its structure and composition, which can bee seen in the phytosociological data, as well as the diversity data. Each management practice was found to have a significant impact on the species composition of each ecotope. More specifically, not only is it merely the management but the intensity of the forest management (Table 4 & 5).

In this study disturbance can be considered the management exerted within each landscape unit and an intermediate level of disturbance can be considered the level that can maximize species diversity (Connell, 1978; Hughes, 2012; Huston 1979; Myers & Bazley, 2003). In the ecotopes with intermediate disturbances had a higher or equal H', PIE and richness than the National Forest, a conservation unit which experiences no management practices for the past 70 years. These ecotopes with intermediate management all had higher diversity indices than those with intensive management practices, where herbaceous layer is removed excessively, only a couple of species are favored, the presence of cattle is constant, and almost all the cerninho is removed. The same pattern is seen in the cluster analysis, where the ecotopes with intermediate management are grouped similarly than those with intensive management.

The landscape unit that stands out from all others in the aspect of management is the Campo. This landscape unit, which once was an Araucaria Forest, was intensively managed to favor one species, *Ilex paraguariensis*. The other two landscape units that are intensively managed are the Barbaqua and the Taquaral. Due to their historical use of these landscapes and current management practices these two landscape units were intensively used and modified to favor the species *Ilex paraguariensis*.

The changes in landscape structure and species composition of plant communities due to human influences can be perceived through the data collected in the ecotopes of the Araucaria Forest in the northern plateau of Santa Catarina. Some of these ecotopes with historical and current anthropogenic disturbances, in this case management practices with varying frequencies, show that the maintenance of diversity within the plant community. These ecotopes are constantly changing due to management practices, therefore they maybe never have a chance to reach an equilibrium state, and so it is possible to see that the maximization of species diversity is found in those under intermediate disturbances. The ecotopes *Mato*, *Mato Fechado*, and all the *Caívas*, except *Caíva* A, are examples of this nonequilibrium state due to anthropogenic disturbances that has maintained and conserved the

Araucaria Forest. These are not natural landscapes but in fact may be considered cultural ecotopes, which have been transformed historically.

In historical ecology researchers look to the past managements and transformations, as well as current, to inform the future (Crumley, 1994), and the Araucaria Forest landscape has a long history of management that is traced back to indigenous groups (Carvalho, 2010). The indigenous groups, as the Jê group, helped expand and promote the araucaria in southern Brazil. The tropeiros passing by colonized the area in search of erva-mate, beginning a cycle of intensive erva-mate extraction, also promoting and making this species abundant throughout almost all the northern plateau landscape (Carvalho, 2010). The colonizers also furthered the spread and extraction of erva-mate, and consequently of timber resources imbuia and araucaria. These previous transformers of landscape, modified the Araucaria Forest landscape so that today those of the northern plateau are able to use and continue the tradition of extraction of erva-mate on their properties, to be able to use and celebrate the *pinhão*.

Many of these traditional management practices continue to shape the landscape today, and to promote many species through their use. However, some of the traditional managements are being lost, and as consequence people are allowing their erva-mate's to dry out and die, they remove araucaria seedlings from their forest area, as well as the species bracatinga (*Mimosa scabrella*), primarily used as firewood, among other species (Mello, 2013, chapter 1 of this dissertation). Another interesting finding from Mello (2013, first chapter of this dissertation) was that of all informants, 54% stated that they are not allowed to use forest areas like before, so they would rather deforest their *caívas* and remaining forest areas to create more cultivation areas. These species and ecotopes were once promoted by local populations because of its cultural importance in traditional management system caíva. In order to guarantee the future of the Araucaria Forest landscape, regulations, conservationists, and all the like must promote conservation of these areas through use.

3.5. CONCLUSIONS

The most dominant species within the cultural landscape units and the National Forest were *Ilex paraguariensis* and *Araucaria angustifolia*. The use and extraction of these two species changed the Araucaria Forest landscape. Most of the other species important in the Araucaria landscape are primarily used for firewood and timber. In

managed areas with intermediate disturbances, that is, where the frequency of management practices is intermediate, the diversity and richness are higher than areas of conservation units and areas of intense management.

Using a historical ecology and ethnoecology perspective is relevant in deepening studies of landscape, especially cultural landscapes. These studies are important to understand how humans dialectically interact with environments, and are not in fact just destroying environments, but also conserving plant resources through traditional management systems. These studies can align history, with current practices to better inform conservation needs. In this case the use of *caívas*, a cultural landscape unit, has maintained areas of Araucaria Forest on private property, as well transformed these areas based on cultural use of certain plant resources. The conservation of Araucaria Forest areas on private property is due to the traditional management practices and use of natural resources. Most of the Araucaria Forest is found in private property, very little of this ecosystem is within conservation units, therefore aligning the intermediate use of these properties with conservation, may further help conserve these areas while maintaining and maximizing biodiversity.

It is important that discussions are generated in regards to conservation by use of these forest areas. These areas have been used for many years, and still remain, some areas with greater diversity than areas not utilized. The Araucaria Forest provides resources for families and its use is historical. Within this context, it is important to generate discussions within popular and academic fields on how management and use of *caívas* and can work both for biodiversity conservation and for the livelihood of traditional communities, while producing new knowledge on populations living in areas of the Brazilian Araucaria Forest.

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4. CONSIDERAÇÕES FINAIS

As caívas são ecotopos culturais, que representam o resultado de anos de praticas de manejo e favorecimento de espécies, que continuam mantendo a biodiversidade da Floresta Ombrófila Mista. As populações locais do planalto norte tem conservado suas áreas de caívas por causa da extração das espécies *Ilex paraguariensis* e do pinhão da *Araucaria angustifolia* e os resultados dos estudos fitossociológicos mostram a dominância dessas duas espécies dentro dos ecótopos culturais da FOM.

A diversidade e riqueza de espécies nesses ecótopos culturais dependem da intensidade de manejo. Como visto nos resultados, os ecótopos, apresentadas no capítulo 2, submetidas a ações de manejo com distúrbios de intensidade intermediária apresentam uma riqueza e diversidade maior, quando comparado com uma área de Floresta Nacional aonde não houve manejo durante 70 anos.

A prática de manejo mais citada durante o estudo etnoecológico foi a extração de erva-mate. A extração de erva-mate tem uma importância cultural que remonta a um período anterior ao século XIX, mas intensificado pela chegada dos tropeiros e colonos na região da Floresta Ombrófila Mista. A paisagem da Floresta Ombrófila Mista foi transformada devido ao uso de diversas espécies mas a extração de erva-mate foi favorecida ao longo dos anos nesses ecótopos culturais, o que parece evidente pela sua dominância em todas as ecótopos manejadas. As populações locais do planalto norte continuam o manejo da erva-mate, citando este como melhor uso para as caívas, inclusive para seu plantio. Porém, ao contrário do favorecimento desta espécie outras tem sofrido ações contrárias, especialmente no caso do cerninho (*Curitiba prismatica*), que é tratada como uma espécie invasora.

A araucária também é um símbolo cultural importante para as comunidades do planalto norte catarinense, sendo que o uso mais intensivo, para a extração de madeira, também remonta ao século XIX. Muitos informantes relataram que no passado apenas indivíduos com DAP grande eram utilizados e que deixavam indivíduos jovens para que futuramente seus filhos também pudessem usar como recurso. O principal uso atual esta relacionado a extração e uso do pinhão, sendo um recurso bastante utilizado por todos, havendo inclusive uma festa, em uma das comunidades (Campininha) somente para comemoram este recurso.

As pessoas estão exercitando o uso e manejo dessas áreas de caívas há muitos anos, e dizem ter um entendimento da intensidade que

devem utilizar para extrair recursos vegetais nestas áreas sem comprometer o uso no futuro. Caívas não são caívas sem as praticas de manejo de extração da erva-mate, criação de gado no sub-bosque e o uso de recursos vegetais. Porem, as comunidades locais também mencionam que muito tem mudado em relação ao manejo de caívas, e que essas mudanças implicaram em uma restrição de uso de vários recursos florestais que antes estavam disponíveis. As populações locais relatam que havia mais atenção com as caívas antigamente, especialmente quando podiam usar os recursos de lenha e madeira sem as restrições atuais da legislação ambiental.

Vários informantes relataram que uma caíva é uma herança para seus filhos, porem destacam que atualmente a falta de parâmetros para uso das espécies, ou mesmo da total proibição de uso, faz com estas áreas não recebam por parte deles o mesmo valor que existia há alguns anos atrás. Junto com essa desvalorização cultural, ou falta de interesse pelo uso e manutenção destas áreas, espécies como a araucária também perderam seu valor para muitos nas comunidades, e alguns informantes citaram que não cuidam mais das araucárias como antes. Destacam que ao contrário de cuidar das plântulas que recrutam na população, estas são eliminadas porque podem ser motivo de restrições no uso do solo em locais onde indivíduos adultos sobrevivem. Este procedimento é claramente relacionado às restrições de corte devido ao fato da espécie estar na lista de espécies ameaçadas de extinção e reflete um paradoxo, uma vez que os reflexos esperados de uma lista de espécies ameaçadas seria justamente sua conservação, e ampliação dos tamanhos populacionais tanto dentro como fora de unidades de conservação.

A ecologia histórica e etnoecologia são abordagens relevantes para aprofundar os estudos de paisagens culturais, e a forma como os seres humanos interagem dialeticamente com os ambientes. Permite uma melhor compreensão sobre os fatores que fazem com que as ações humanas possam causar perdas, mas também resultem em conservação das espécies através de sistemas de manejo tradicionais. Neste sentido, estas perspectivas ajudam no aprimoramento de estratégias de conservação pelo uso de áreas de florestas em propriedades privadas, e que podem ser complementares às para unidades de conservação de grande extensão, uma vez que a FOM é altamente fragmentada.

Os resultados obtidos no presente estudo reforçam a necessidade de outros estudos que podem ser feitos para valorizar ações de conservação associadas ao uso tradicional das caívas. Além disso, a criação de regulações, ou políticas públicas, podem ajudar a regulamentar o uso de recursos vegetais quando associados à

valorização do manejo tradicional. Uma vez que a maioria dessas áreas de caívas não são áreas de cultivo, ações que regulamentem e ordenem a extração de recursos vegetais podem ser usadas em conjunto às estratégias de conservação convencionais, resultando em conservação de biodiversidade de áreas maiores e com isso reduzir a pressão negativa sobre as áreas da FOM. Perante este panorama, seria importante também gerar discussões mais amplas no âmbito popular e acadêmico sobre intensidade manejo e uso de caívas e como essas podem funcionar tanto para a conservação da biodiversidade como para a manutenção das condições de existência e da produção de novos conhecimentos pelas populações humanas que vivem nas áreas de Floresta Ombrófila Mista no Brasil.

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6. APÊNDICES

APÊNDICE 1

Semi-structured interview and checklist interview carried out with informants from the communities of KM 6, Barra Grande, Campininha, Colônia Escada, Forquilhas and Colônia Ruthes.

Roteiro Semi-estruturado

Etnoecologia e manejo local de paisagens antrópicas na Floresta Ombrófila Mista Catarinense

Nome:_____
Idade:_____ **Gênero**:( )**M**( )**F** **Data**:_____
Nºentrevista:_____
Município/Comunidade:_____
Entrevistador(s):_____

PART 1: DADOS PESSOAIS

PERGUNTA INICIAL) Existe caívas na sua propriedade?
Se não, que tipo de área há em sua propriedade?

1) Onde nasceu/de onde veio? (Cidade/estado)Há quanto tempo reside no local?

Anotar história de vida (historia da pessoa no local):

1.2) Qual sua ocupação atual (relacionada ao uso da propriedade):

1.3) Qual a atividade que gera a principal renda atualmente, na família? Você sempre viveu disso? Se não, Quando mudou? Porque? (Atividades da propriedade e não só de fonte de renda).

PARTE 2: CARACTERIZAÇAO DE CONHECIMENTO SOBRE CAÍVAS

2.1. Fale-me o que é uma caíva?

2.2. Diga-me qual o significado da palavra caíva

2.3) O que difere uma caíva das outras áreas com floresta (mata)?

2.4) Existe diferentes tipos de caíva? Quais são? Você tem diferentes tipos de caíva na sua propriedade?
Existe outro nome para estas áreas?

2.5) Sempre existiu caívas na sua propriedade?

2.6) Que tamanho tem a sua propriedade?
2.7) Que tamanho tem as áreas ocupadas com caíva(s) na sua propriedade?

2.5) Fale-me sobre as mudanças que ocorreram nas caívas nos últimos 50 anos? Quando foram? Qual foi a mudança?
Fale-me sobre as mudanças que ocorreram na sua propriedade ao longo dos anos?
2.6) Que tipos de atividades existem na(s) caíva(s)
2.7.A caíva gera renda para a família? Que tipo de atividades dentro da caíva geram renda?

PARTE 3: MANEJO DE CAÍVAS e ESPECIES

3.1) O Sr(a) faz algum destes tipos de manejo?
( ) roçada da área com trator ( ) roçada da área com enxada ( ) poda de galhos de erva-mate ( ) poda de galhos de outra espécie ( ) favorece a erva-mate ( ) favorece outra espécie ( ) planta erva-mate dentro da caíva (enriquece) ( ) planta outra espécie (enriquece).

Faz algum outro tipo de manejo das espécies na(s) caíva(s) não citadas anteriormente? Qual?

Qual é a frequência destes manejo?
( )__todos os dias ( ) toda semana ( ) a cada 15 dias ( ) uma vez por mês ( ) outro (especifique)

Que ferramentas usa?

3.2) Cria/solta algum destes animais na áreas de caívas em sua propriedade?

( ) gado de leite ( )gado de corte ( ) galinhas ( ) porcos

Quanto ao gado (leite ou abate). Há diferenças no tipo de alimentação dada para o animal ou a criação nas caívas?

Quantos de cada?

Já teve menos ou mais animais na sua área?

Faz algum tipo de rotação dos animais nas áreas de caívas? ( ) sim ( ) não Se sim, qual frequência?

3.3) Houve alguma mudança no manejo das áreas ao longo do tempo?

3.4) Mudou alguma coisa na sua vida ou nas atividades que você exerce nas caívas? ( ) sim ( ) não

Diga-me o que mudou?

( ) renda ( ) na forma de obtenção de recursos ( ) não pensava em conservar antes e agora conservo/preocupação com a conservação? Porque?

Qual uso poderia ser dado para as caívas?

( ) aumentar o número de animais

( ) aumentar o plantio de erva-mate

( ) explorar o uso de outras espécies

( ) não usar, e deixar como área de preservação

Ultima pergunta: O senhor(a) conhece outras áreas, pessoas ou comunidades que também existem caívas? Qual(is)?

PARTE 4: USO DE PLANTAS

USO (escreve para que utilizava)FREQUENCIA:

DISPONIBILIDADE:

1 madeira/lenha
2 medicinal
3 consumo para animal
4 alimentação
5 utensílio

1 Usa sempre
2 Algumas vezes
3 Quase nunca usa

1 Muito abundante
2 Pouco abundante
3 Quase não existe

Nome comum	Uso	Uso Historico	Manejo	Frequencia de uso	Disponibilidade do Recurso
Caraguatá					
Espinheira santa					
Pinheiro/ Araucaria					
Cataia					
Erva-mate					
Pau-Andrade					
Bracatinga					
Cedro					
Guavirova					
Cambará					
Cerninho					
Cuvatã					

Guamirim					
Imbuia					
Pau amargo					
Pitanga					
Araçá					
Araticum					
Canela Guaíca					
Aroreira					

APÊNDICE 2:

The prior informed consent model used to gain consent to conduct the research from participants.

Termo de consentimento (autorização) para a realização de pesquisa.
(O termo técnico é chamado de "Termo de anuência prévia")

Este documento tem como objetivo explicar o que pretendemos fazer aqui e, se vocês concordarem, pediremos para vocês assinarem no final. A participação nesta pesquisa, respondendo às perguntas que faremos, é voluntária. A qualquer momento vocês podem desistir de participar, sem nenhum prejuízo.

Sou a **Anna Jacinta Machado Mello**, estudante da Universidade Federal de Santa Catarina, em Florianópolis-SC, e estou desenvolvendo um trabalho sobre o uso e manejo de plantas em *Caívas*. Os nome do trabalho desenvolvido é "**Etnoecologia e manejo local de paisagens antrópicas na Floresta Ombrófila Mista Catarinense"**

Floresta Ombrófila Mista, é o nome que se dá para as florestas nativas do sul do Brasil conhecidas também como **Floresta de Araucária**, por causa do **Pinheiro brasileiro** (**Araucária**). Além de mim, participa deste trabalho o professor **Nivaldo Peroni** da Universidade Federal de Santa Catarina.

O que queremos com este trabalho é conhecer os usos que são feitos das plantas das caívas e sobre o manejo das caívas. Para que este trabalho possa ser realizado, gostaríamos de pedir autorização para visitá-lo(a), conversar sobre as plantas e sobre a floresta, assim como tirar algumas fotos das plantas e de vocês. O nome popular das plantas é muito importante para nós mas algumas amostras de plantas serão coletadas e levadas para o laboratório para que possamos identificar o nome científico. Além disso, se for possível, iremos pedir para marcarmos algumas plantas nas áreas de floresta que vocês usam.

A qualquer hora o senhor ou a senhora pode parar nossa conversa ou desistir de participar do trabalho, sem trazer nenhum prejuízo. Nós vamos escrever o que nós aprendemos aqui com vocês em revistas para divulgar a pesquisa e vamos também dar aulas e palestras sobre isso para os nossos alunos na Universidade e para a toda a sociedade. Gostaríamos de, no futuro, retornar os resultados do nosso trabalho em reuniões com a comunidade que vocês moram para troca de idéias, ou outras formas que vocês acharem conveniente. Se houver

alguma informação que vocês desejem manter em segredo, nós não iremos divulgar. Também só colocaremos o nome de vocês ou a foto, em revistas ou livros, se isso for permitido por vocês. Vamos tentar incomodar o mínimo possível nas suas atividades do dia a dia.

Caso tenha alguma dúvida basta me perguntar, ou nos telefonar. Nosso telefone e endereço são: Laboratório de Ecologia Humana e Etnobotânica, Centro de Ciências Biológicas/ Departamento de Ecologia e Zoologia, Universidade Federal de Santa Catarina – Campus Trindade, Bloco C, Térreo, Sala 009, Florianópolis, SC 880010-970 - Fone: (48) 3721-9460 ou (48) 3721-4741 (Prof. Nivaldo) ou (48) 9649-4633 (Anna Jacinta).

Pelo presente termo, atesto que estou ciente e que concordo com a realização do estudo.

APÊNDICE 3:

Table 3. Proportions of citations for current and historical use, current use frequency, historical use frequency, availability of species, part of plant utilized and description of use from "checklist" interview for twenty arboreal species found in the Araucaria Forest. (Current and historical use frequency: 1=Always uses; 2= sometimes uses; 3= never uses. Availability: 1= very abundant; 2=not abundant; 3= almost does not exist).

Species	Current use	Historical use	Current use frequency	Historical use frequency	Availability	Part of plant utilized	Description of use
Caraguatá (*Bromelia Antiacantha* Bertol.)	Medicinal (45%) Tool (26.3%) Food (26.3%) Animal food (2.6%)	Medicinal (31.8%) Food (31.82%) Tool (36.4%)	1 (41.2%) 2 (29.4%) 3 (29.4%)	1 (28.6%) 2 (28.6%) 3 (42.8%)	1 (40%) 2 (28%) 3 (32%)	Fruit, whole plant, and palm-heart.	The whole plant is used to build live fences. The fruit is used to make expectorant syrup for bronchitis. The palm-heart is used as a food source. The fruit is also available to feed animals.
Espinheira-santa (*Maytenus boaria* Molina.)	Medicinal (80%) Drink (20%)	Medicinal (91%) Firewood (9%)	1 (35%) 2 (45%) 3 (20%)	1 (46.2%) 2 (38.5%) 3 (15.4%)	1 (3.9%) 2 (23.1%) 3 (73.1%)	Leaves, trunk and branches.	The leaves are used in chimarrão and as a medicinal herb to treat stomach ailments, blood clotting, and for back pain. One informant cited as a timber resource historically.
Araucaria (*Araucaria angustifolia* (Bertol.) Kuntze)	Timber/firewood (26.7%) Medicinal (4.4%) Animal food (4.4%) Food (62.2%) Tool (2.2%)	Timber/firewood (76.7%) Medicinal (3.3%) Animal food (6.7%) Food (6.7%) Tool (6.7%)	1 (78.6%) 2 (10.7%) 3 (10.7%)	1 (60.7%) 2 (21.4%) 3 (17.9%)	1 (77%) 2 (19.2%) 3 (3.9%)	Pinhão, trunk, branches, leaves.	Pinhão is used as a food source, as well as a timber and its branches and leaves are used for firewood. The small plantlets are used as Christmas trees.

Cataia (*Drimys brasiliensis* Miers.)	Medicinal (100%)	Medicinal (88.5%) Firewood (7.7%) Animal use (3.8%)	1 (14.3%) 2 (35.7%) 3 (50%)	1 (45.8%) 2 (12.5%) 3 (41.2%)	1 (30.8%) 2 (34.6%) 3 (34.6%)	Bark, trunk and branches.	The bark is used to make a tea to cure coughing, more specifically of horses, but also works for humans. Branches and trunk used as firewood.
Erva-mate (*Ilex paraguariensis* A.Sant.-Hil)	Drink (84.8%) Medicinal (6.1%) Firewood (9.1%)	Drink (87.5%) Medicinal (8.3%) Firewood (4.2%)	1 (82.1%) 2 (3.6%) 3 (14.3%)	1 (91.7%) 2 (0%) 3 (8.3%)	1 (61.5%) 2 (30.8%) 3 (7.8%)	Leaves and branches.	Leaves are used in chimarrão. Branches and leaves toasted are used as a tea. Some branches are also used as firewood.
Pau-de-andrade (*Persea major* (Meisn.) L.E.Kopp))	Medicinal (100%)	Medicinal (100%)	1 (6.7%) 2 (53.3%) 3 (40%)	1 (21.1%) 2 (42.1%) 3 (36.8%)	1 (0%) 2 (24%) 3 (76%)	Bark.	Bark is left in water to make a wash for closing cuts.
Bracatinga (*Mimosa scabrella* Benth.)	Firewood (81.5%) Animal food (14.8%) Medicinal (3.7%)	Firewood (82.8%) Animal food (6.9%) Tool (6.9%) Medicinal (3.4%)	1 (40.9%) 2 (36.4%) 3 (22.7%)	1 (63%) 2 (18.5%) 3 (18.5%)	1 (0%) 2 (50%) 3 (50%)	Flowers, trunk, and branches	Flowers are used in beekeeping. Trunk and branches are used as firewood. Used to make grips for tools.
Cedro (*Cedrela fissilis* Vell.)	Timber (25%) Medicinal (75%)	Timber (58.6%) Tool (41.4%)	1 (25%) 2 (25%) 3 (50%)	1 (23.8%) 2 (28.6%) 3 (47.6%)	1 (7.7%) 2 (38.5%) 3 (53.8%)	Trunk and bark.	Used to built boats, furniture, basins, doors, windows, and troughs. Used as a vermicide for chicken.
Guavirova (*Campomanesia* sp.)	Food (50%) Animal food (26.3%) Medicinal (13.2%) Firewood (10.5%)	Food (30.8%) Animal food (34.6%) Medicinal (3.9%) Firewood (26.9%) Tool (3.8%)	1 (29.2%) 2 (29.2%) 3 (41.6%)	1 (40.9%) 2 (31.8%) 3 (27.3%)	1 (26.9%) 2 (53.9%) 3 (19.2%)	Fruit, flower, trunk, branches and leaves.	Fruit for human & animal consumption, to make jellies and jams. Flowers in beekeeping. Branches and trunk as firewood. Leaves for tea for stomach ailments, coughs, and cholesterol.

Cambará (*Gochnatia polymorpha* (Less.) Cabrera)	Timber (58.8%) Medicinal (29.4%) Tool (11.8%)	Timber (82.6%) Medicinal (8.7%) Tool (8.7%)	1 (20%) 2 (13.3%) 3 (66.7%)	1 (47.8%) 2 (13.1%) 3 (39.1%)	1 (12%) 2 (36%) 3 (52%)	Trunk and leaves.	Used to build fences. Leaves used to make cough syrup and tea for diabetes.
Cerninho (*Curitiba prismatica* (D.Legrand) Salywon & Landrum)	Timber/firewood (95%) Tool (5%)	Timber/firewood (86.4%) Tool (13.6%)	1 (50%) 2 (35%) 3 (15%)	1 (33.3%) 2 (38.1%) 3 (28.6%)	1 (62.5%) 2 (12.5%) 3 (25%)	Trunk.	Used to build fences and tool grips.
Cuvatã (*Cupania vernalis* Cambessedes)	Firewood/timber (92.3%) Animal food (7.7%)	Firewood/timber (89.4%) Medicinal (5.3%) Food (5.3%)	1 (23.1%) 2 (30.8%) 3 (46.1%)	1 (36.8%) 2 (36.8%) 3 (26.3%)	1 (16.7%) 2 (41.7%) 3 (41.7%)	Trunk, flower and bark.	Used as firewood, and to make tool grips. Flower for beekeeping. Tea of bark used to treat kidneys.
Guamirim (*Myrcia* sp.)	Firewood (81.3%) Animal food (12.5%) Food (6.2%	Firewood (89.5%) Animal food (10.5%)	1 (13.3%) 2 (33.3%) 3 (53.3%)	1 (41.2%) 2 (35.3%) 3 (23.5%)	1 (16.7%) 2 (29.2%) 3 (54.2%)	Trunk, branches and fruit.	Trunk and branches used as firewood. Fruit used as human and animal food.
Imbuia (*Ocotea porosa* (Nees & Mart.) Barroso)	Timber (100%)	Timber (96.4%) Tool (3.6%)	1 (0%) 2 (0%) 3 (100%)	1 (48.2%) 2 (29.6%) 3 (22.2%)	1 (15.4%) 2 (46.2%) 3 (38.4%)	Trunk.	Used to make floorboards, ceilings, houses, and fences.
Pau-amargo (*Picramnia parvifolia* Engler.)	Medicinal (100%)	Medicinal (100%)	1 (27.3%) 2 (27.3%) 3 (45.4%)	1 (50%) 2 (28.6%) 3 (21.4%)	1 (0%) 2 (5.3%) 3 (94.7%)	Bark.	Bark soaked in water used to make medicinal drink for stomach ulcers.

Pitanga (*Eugenia uniflora* L.)	Medicinal (27.2%) Animal food (6.1%) Food (66.7%)	Timber (17.6%) Medicinal (29.4%) Food (52.9%)	1 (18.2%) 2 (54.5%) 3 (27.3%)	1 (50%) 2 (28.6%) 3 (21.4%)	1 (11.5%) 2 (34.6%) 3 (53.8%)	Leaves, fruits, trunk.	Leaves for tea for regulating blood pressure and coughs. Trunk for making fences. Fruits for human and animal consumption, make jellies and jams
Araça (*Psidium cattleianum* Sabine)	Medicinal (17.2%) Food (69%) Tool (3.4%) Animal food (10.4%)	Medicinal (5.5%) Food (50%) Tool (22.2%) Animal food (11.1%) Firewood (11.1%)	1 (27.3%) 2 (45.4%) 3 (27.3%)	1 (15%) 2 (45%) 3 (40%)	1 (11.5%) 2 (19.2%) 3 (69.3%)	Fruit, trunk and leaves.	Leaves for stomach and intestinal ailments. Fruits used to make jellies and jams. Fruit in natura for animal consumption. Trunk used to make tool grips.
Ariticum (*Annona* sp.)	Food (92%) Firewood (4%) Animal food (4%)	Food (78.6%) Tools (14.3%) Animal food (7.1%)	1 (26.1%) 2 (52.2%) 3 (21.7%)	1 (47.1%) 2 (29.4%) 3 (23.5%)	1 (4.2%) 2 (70.8%) 3 (29%)	Fruit.	Fruits used for human and animal consumption, to make jellies and jams
Canela guiaca (*Ocotea puberula* (Rich.) Nees)	Timber/firewood (75%) Animal food (25%)	Timber/firewood (100%)	1 (25%) 2 (50%) 3 (25%)	1 (55.6%) 2 (33.3%) 3 (11.1%)	1 (40%) 2 (40%) 3 (20%)	Flowers, trunk and branches.	Used as firewood and wooden boards for construction. Flowers used in beekeeping.
Aroeira (*Schinus terebinthifolius* Raddi)	Medicinal (52.9%) Timber/firewood (29.4%) Animal food (11.8%) Tool (5.9%)	Timber/firewood (61.9%) Medicinal (38.1%)	1 (14.3%) 2 (42.9%) 3 (42.9%)	1 (25%) 2 (40%) 3 (35%)	1 (11.5%) 2 (61.5%) 3 (26.9%)	Leaves, flowers, branches and trunk.	Leaves used to make tea for toothaches. Cures allergies caused by the Aroeira-brava (*Lithrea brasiliensis*). Leaves are used as an anesthetic. Trunk and branches used as firewood and timber. Flowers for beekeeping. Also used to make grips for tools.

Appendix 4: Tables A4.1-11 of phytosiociological data for eleven ecotopes found in the comunities of Campininha, Colônia Escada and National Forest of Três Barras in the Northern Plateau of Santa Catarina, Brazil.

A4.1. Phytosociological data for the ecotope *Barbaqua* from the rural community of Campininha, Três Barras, Santa Catarina, Brazil.

Taxonomic Species	Taxonomic Family	N	DA N/ha	DR	FA %	FR	DoA m2/ha	DoR	IVI
Ilex paraguariensis	Aquifoliaceae	186	387.5	54.0698	100%	0.04918	6.33802	24.8458	78.96
Araucaria angustifolia	Araucariaceae	28	58.33	8.13953	100%	0.04918	7.22955	28.3407	36.53
Curitiba prismatica	Myrtaceae	29	60.42	8.43023	100%	0.04918	1.40136	5.49351	13.97
Casearia sylvestris	Salicaceae	18	37.50	5.23256	100%	0.04918	0.75276	2.95093	8.23
Ocotea puberula	Lauraceae	6	12.50	1.74419	66.66%	0.03279	1.55976	6.11447	7.89
Cedrela fissilis	Meliaceae	6	12.50	1.74419	100%	0.04918	1.13337	4.44294	6.24
Arecastrum romanzoffianum	Arecaceae	5	10.42	1.45349	100%	0.04918	0.59535	2.33386	3.84
Ilex dumosa	Aquifoliaceae	2	4.17	0.58140	33.33%	0.01639	0.82121	3.21924	3.82
Sloanea guianensis	Elaeocarpaceae	2	4.17	0.58140	33.33%	0.01639	0.69834	2.73757	3.34
Cinnamomum amoenum	Lauraceae	2	4.17	0.58140	66.66%	0.03279	0.60675	2.37853	2.99
Myrcia splendens	Myrtaceae	6	12.50	1.74419	66.66%	0.03279	0.27015	1.05902	2.84
Symplocos trachycarpos	Symplocaceae	2	4.17	0.58140	66.66%	0.03279	0.51629	2.02393	2.64
Myrsine coriacea	Myrsinaceae	6	12.50	1.74419	66.66%	0.03279	0.19171	0.75153	2.53

Mollinedia schottiana	Monimiaceae	3	6.25	0.87209	33.33%	0.01639	0.38378	1.50445	2.39
Casearia obliqua	Salicaceae	5	10.42	1.45349	66.66%	0.03279	0.15782	0.61867	2.10
Campomanesia rhombea	Myrtaceae	4	8.33	1.16279	100%	0.0491	0.17623	0.69086	1.90
Jacaranda puberula	Bignoniaceae	3	6.25	0.87209	33.33%	0.01639	0.24432	0.95778	1.85
Ocotea silvestris	Lauraceae	1	2.08	0.29070	33.33%	0.01639	0.28601	1.12119	1.43
Nectandra megapotamica	Lauraceae	2	4.17	0.58140	33.33%	0.01639	0.18140	0.71112	1.31
Myrsine umbellata	Myrsinaceae	2	4.17	0.58140	33.33%	0.01639	0.17328	0.67927	1.28
Campomanesia xanthocarpa	Myrtaceae	3	6.25	0.87209	66.66%	0.03279	0.08829	0.34613	1.25
Rhamnus sphaerosperma	Rhamnaceae	3	6.25	0.87209	33.33%	0.01639	0.07002	0.27450	1.16
Cinnamodendron dinisii	Canellaceae	1	2.08	0.29070	33.33%	0.01639	0.20034	0.78535	1.09
Nectandra lanceolata	Lauraceae	1	2.08	0.29070	33.33%	0.01639	0.20034	0.78535	1.09
Matayba elaegnoides	Sapindaceae	2	4.17	0.58140	33.33%	0.01639	0.11246	0.44085	1.04
Drimys brasiliensis	Winteraceae	1	2.08	0.29070	33.33%	0.01639	0.18501	0.72525	1.03
Allophylus edulis	Sapindaceae	2	4.17	0.58140	66.66%	0.03279	0.09578	0.37546	0.99
Baccharis sp	Asteraceae	1	2.08	0.29070	33.33%	0.01639	0.17062	0.66886	0.98
Ocotea sp	Lauraceae	1	2.08	0.29070	33.33%	0.01639	0.15213	0.59639	0.90
Lithrea brasiliensis	Anacardiaceae	1	2.08	0.29070	33.33%	0.01639	0.13659	0.53546	0.84
Eugenia pluriflora	Myrtaceae	2	4.17	0.58140	33.33%	0.01639	0.05883	0.23064	0.83
Psidium cattleianum	Myrtaceae	1	2.08	0.29070	33.33%	0.01639	0.09186	0.36010	0.67

Ocotea diospyrifolia	Lauraceae	1	2.08	0.29070	33.33%	0.01639	0.07915	0.31029	0.62
Strychnos brasiliensis	Loganiaceae	1	2.08	0.29070	33.33%	0.01639	0.04187	0.16412	0.47
Zanthoxylum fagara	Rutaceae	1	2.08	0.29070	33.33%	0.01639	0.03778	0.14812	0.46
Sapium glandulosum	Euphorbiaceae	1	2.08	0.29070	33.33%	0.01639	0.02277	0.08927	0.40
Erythroxylum deciduum	Erythroxylaceae	1	2.08	0.29070	33.33%	0.01639	0.02125	0.08332	0.39
Ilex theezans	Aquifoliaceae	1	2.08	0.29070	33.33%	0.01639	0.02088	0.08186	0.39
Not identified	Not identified	1	2.08	0.29070	33.33%	0.01639	0.00595	0.02332	0.33
TOTAL	22	344	716.7	100	2033.2	1	25.51	100	201

A4.2. Phytosociological data for the ecotope Taquaral from the rural community of Campininha, Três Barras, Santa Catarina, Brazil.

Taxonomic Species	**Taxonomic Family**	**N**	**DA N/ha**	**DR**	**FA %**	**FR**	**DoA (m2/ha)**	**DoR**	**IVI**
Ilex paraguariensis	Aquifoliaceae	268	558.33	77.4566	100%	0.07895	5.16286	47.7257	125.26
Araucaria angustifolia	Araucariaceae	15	31.25	4.33526	100%	0.07895	2.00014	18.4894	22.90
Acca sellowiana	Myrtaceae	5	10.42	1.44509	66.67%	0.05264	0.58542	5.41168	6.91
Rhamnus sphaerosperma	Rhamnaceae	14	29.17	4.04624	66.67%	0.05264	0.24181	2.23533	6.33
Piptocarpha angustifolia	Asteraceae	4	8.33	1.15607	33.33%	0.02631	0.44369	4.10151	5.28
Curitiba prismatica	Myrtaceae	4	8.33	1.15607	66.67%	0.05264	0.38150	3.52659	4.74
Myrcia splendens	Myrtaceae	6	12.50	1.73410	66.67%	0.05264	0.23710	2.19176	3.98

Ocotea pulchella	Lauraceae	1	2.08	0.28902	33.33%	0.02631	0.26167	2.41886	2.73
Vernonanthura discolor	Asteraceae	2	4.17	0.57803	33.33%	0.02631	0.18122	1.67520	2.28
Not identified	Not identified	2	4.17	0.57803	33.33%	0.02631	0.17003	1.57176	2.18
Allophylus edulis	Sapindaceae	2	4.17	0.57803	66.67%	0.05264	0.15175	1.40277	2.03
Zanthoxylum fagara	Rutaceae	4	8.33	1.15607	100.00 %	0.07895	0.08438	0.78004	2.02
Lamanonia ternata	Cunoniaceae	1	2.08	0.28902	33.33%	0.02631	0.17251	1.59471	1.91
Inga lentiscifolia	Mimosaceae	2	4.17	0.57803	33.33%	0.02631	0.11912	1.10116	1.71
Sebastiania commersoniana	Euphorbiaceae	1	2.08	0.28902	33.33%	0.02631	0.14662	1.35535	1.67
Ocotea porosa	Lauraceae	1	2.08	0.28902	33.33%	0.02631	0.13098	1.21077	1.53
Drimys brasiliensis	Winteraceae	2	4.17	0.57803	33.33%	0.02631	0.06691	0.61853	1.22
Piptocarpha axillaris	Asteraceae	1	2.08	0.28902	33.33%	0.02631	0.07630	0.70534	1.02
Dalbergia frutescens	Fabaceae	1	2.08	0.28902	33.33%	0.02631	0.07490	0.69234	1.01
Lithrea brasiliensis	Anacardiaceae	1	2.08	0.28902	33.33%	0.02631	0.04895	0.45246	0.77
Annona neosalicifolia	Annonaceae	2	4.17	0.57803	33.33%	0.02631	0.01131	0.10452	0.71
Schinus terebinthifolius	Anacardiaceae	1	2.08	0.28902	33.33%	0.02631	0.03680	0.34015	0.66
Casearia sylvestris	Salicaceae	2	4.17	0.57803	33.33%	0.02631	0.00063	0.00587	0.61
Ilex theezans	Aquifoliaceae	1	2.08	0.28902	33.33%	0.02631	0.03070	0.28375	0.60
Ilex dumosa	Aquifoliaceae	1	2.08	0.28902	33.33%	0.02631	0.00028	0.00255	0.32
Casearia obliqua	Salicaceae	1	2.08	0.28902	33.33%	0.02631	0.00015	0.00141	0.32

Cabralea canjerana	Meliaceae	1	2.08	0.28902	33.33%	0.02631	0.00005	0.00050	0.32
TOTAL	17	346	720.83	100	1266.6	1	10.82	100	201

A4.3 Phytosociological data for the ecotope Campo from the rural community of Campininha, Três Barras, Santa Catarina, Brazil.

Taxonomic Species	**Taxonomic Family**	**N**	**DA N/ha**	**DR**	**FA %**	**FR**	**DoA (m2/ha)**	**DoR**	**IVI**
Ilex paraguariensis	Aquifoliaceae	324	2025.00	96.71642	100%	0.16667	5.85803	71.41	168.29
Araucaria angustifolia	Araucariaceae	1	6.25	0.29851	100%	0.16667	1.22656	14.95	15.42
Drimys brasiliensis	Winteraceae	1	6.25	0.29851	100%	0.16667	0.51504	6.28	6.74
Mimosa scabrella	Fabaceae	1	6.25	0.29851	100%	0.16667	0.47149	5.75	6.21
Rhamnus sphaerosperma	Rhamnaceae	7	43.75	2.08955	100%	0.16667	0.01022	0.12	2.38
Not identified	Not identified	1	6.25	0.29851	100%	0.16667	0.12266	1.50	1.96
TOTAL	5	335	2093.8	100	600%	1	8.20	100	201

A4.4 Phytosociological data for the ecotope *Caíva* A from the rural community of Campininha, Três Barras, Santa Catarina, Brazil.

Taxonomic Species	Taxonomic Family	N	DA N/ha	DR	FA %	FR	DoA (m2/ha)	DoR	IVI
Araucaria angustifolia	Araucariaceae	30	93.75	15.2284	100%	0.05556	9.84659	51.9794	67.26
Ilex paraguariensis	Aquifoliaceae	94	293.8	47.7157	100%	0.05556	1.45253	7.66780	55.44
Matayba elaegnoides	Sapindaceae	3	9.38	1.52284	50%	0.02778	1.30549	6.89158	8.44
Schinus terebinthifolius	Anacardiaceae	9	28.13	4.56853	50%	0.02778	0.59193	3.12475	7.72
Rhamnus sphaerosperma	Rhamnaceae	13	40.63	6.59898	50%	0.02778	0.00146	0.00772	6.63
Prunus myrtifolia	Rosaceae	1	3.13	0.50761	50%	0.02778	1.09619	5.78668	6.32
Cinnamomum amoenum	Lauraceae	1	3.13	0.50761	50%	0.02778	1.01426	5.35419	5.89
Jacaranda puberula	Bignoniaceae	3	9.38	1.52284	100%	0.05556	0.52444	2.76849	4.35
Curitiba prismatica	Myrtaceae	6	18.75	3.04569	50%	0.02778	0.23670	1.24954	4.32
Clethra scabra	Clethraceae	2	6.25	1.01523	50%	0.02778	0.55016	2.90426	3.95
Casearia decandra	Salicaceae	6	18.75	3.04569	100%	0.05556	0.09423	0.49742	3.60
Vernonanthura discolor	Asteraceae	1	3.13	0.50761	50%	0.02778	0.48719	2.57186	3.11
Zanthoxylum rhoifolium	Rutaceae	2	6.25	1.01523	50%	0.02778	0.30640	1.61747	2.66
Cinnamodendron dinisii	Canellaceae	3	9.38	1.52284	100%	0.05556	0.16685	0.88077	2.46
Zanthoxylum fagara	Rutaceae	3	9.38	1.52284	50%	0.02778	0.15565	0.82168	2.37
Mollinedia schottiana	Monimiaceae	1	3.13	0.50761	50%	0.02778	0.27943	1.47507	2.01

Campomanesia rhombea	Myrtaceae	2	6.25	1.01523	100%	0.05556	0.14558	0.76853	1.84
Not identified	Not identified	3	9.38	1.52284	50%	0.02778	0.00006	0.00032	1.55
Lithrea brasiliensis	Anacardiaceae	1	3.13	0.50761	50%	0.02778	0.18417	0.97222	1.51
Sebastiania commersoniana	Euphorbiaceae	1	3.13	0.50761	50%	0.02778	0.17357	0.91628	1.45
Erythroxylum argentinum	Erythroxylaceae	1	3.13	0.50761	50%	0.02778	0.13663	0.72126	1.26
Vitex megapotamica	Lamiaceae	1	3.13	0.50761	50%	0.02778	0.10715	0.56566	1.10
Miconia sellowiana	Melastomataceae	2	6.25	1.01523	50%	0.02778	0.00035	0.00184	1.04
Solanum sp	Solanaceae	2	6.25	1.01523	50%	0.02778	0.00003	0.00018	1.04
Ilex brevicuspis	Aquifoliaceae	1	3.13	0.50761	50%	0.02778	0.08578	0.45284	0.99
Solanum paranense	Solanaceae	1	3.13	0.50761	50%	0.02778	0.00022	0.00115	0.54
Tibouchina sellowiana	Melastomataceae	1	3.13	0.50761	50%	0.02778	0.00009	0.00047	0.54
Cestrum strigilatum	Solanaceae	1	3.13	0.50761	50%	0.02778	0.00006	0.00032	0.54
Baccharis sp	Asteraceae	1	3.13	0.50761	50%	0.02778	0.00002	0.00013	0.54
Casearia sylvestris	Salicaceae	1	3.13	0.50761	50%	0.02778	0.00002	0.00012	0.54
TOTAL	20	197	615.6	100	1800%	1	18.94	100	201

A4.5. Phytosociological data for the ecotope *Caíva* B from the rural community of Campininha, Três Barras, Santa Catarina, Brazil.

Taxonomic Species	Taxonomic Family	N	DA (N/ha)	DR	FA (%)	FR	DoA (m2/ha)	DoR	IVI
Araucaria angustifolia	Araucariaceae	102	3187.5	34.9315	100%	0.03571	16.7295	76.93317	111.90
Ilex paraguariensis	Aquifoliaceae	45	1406.3	15.4109	100%	0.03571	0.72065	3.31403	18.76
Curitiba prismatica	Myrtaceae	28	875.00	9.58904	100%	0.03571	0.47771	2.19683	11.82
Vernonanthura discolor	Asteraceae	8	250.00	2.73973	100%	0.03571	1.10862	5.09814	7.87
Campomanesia rhombea	Myrtaceae	14	437.50	4.79452	100%	0.03571	0.26521	1.21962	6.05
Cedrela fissilis	Meliaceae	2	62.50	0.68493	50%	0.01786	0.79635	3.66212	4.36
Campomanesia xanthocarpa	Myrtaceae	8	250.00	2.73973	100%	0.03571	0.27241	1.25272	4.03
Not identified	Not identified	5	156.25	1.71233	100%	0.03571	0.33405	1.53620	3.28
Ilex theezans	Aquifoliaceae	5	156.25	1.71233	100%	0.03571	0.21300	0.97954	2.73
Solanum paranense	Solanaceae	7	218.75	2.39726	50%	0.01786	0.00587	0.02697	2.44
Annona sylvatica	Annonaceae	6	187.50	2.05479	50%	0.01786	0.00935	0.04299	2.12
Prunus myrtifolia	Rosaceae	5	156.25	1.71233	50%	0.01786	0.07551	0.34727	2.08
Zanthoxylum fagara	Rutaceae	5	156.25	1.71233	100%	0.03571	0.05428	0.24959	2.00
Eugenia uniflora	Myrtaceae	5	156.25	1.71233	100%	0.03571	0.04490	0.20650	1.95
Ocotea pulchella	Lauraceae	1	31.25	0.34247	50%	0.01786	0.34497	1.58640	1.95

Casearia sylvestris	Salicaceae	5	156.25	1.71233	100%	0.03571	0.01890	0.08693	1.83
Strychnos brasiliensis	Loganiaceae	5	156.25	1.71233	50%	0.01786	0.00419	0.01925	1.75
Allophylus edulis	Sapindaceae	4	125.00	1.36986	100%	0.03571	0.00182	0.00836	1.41
Scutia buxifolia	Rhamnaceae	3	93.75	1.02740	100%	0.03571	0.02447	0.11251	1.18
Eugenia pluriflora	Myrtaceae	2	62.50	0.68493	100%	0.03571	0.05434	0.24988	0.97
Ilex dumosa	Aquifoliaceae	2	62.50	0.68493	50%	0.01786	0.02819	0.12964	0.83
Arecastrum romanzoffianum	Arecaceae	1	31.25	0.34247	50%	0.01786	0.08578	0.39449	0.75
Ocotea puberula	Lauraceae	2	62.50	0.68493	50%	0.01786	0.01109	0.05099	0.75
Ilex brevicuspis	Aquifoliaceae	2	62.50	0.68493	50%	0.01786	0.00895	0.04116	0.74
Acacia bonariensis	Fabaceae	2	62.50	0.68493	50%	0.01786	0.00223	0.01025	0.71
Picramnia parvifolia	Picramniaceae	2	62.50	0.68493	50%	0.01786	0.00123	0.00564	0.71
Rhamnus sphaerosperma	Rhamnaceae	1	31.25	0.34247	50%	0.01786	0.00913	0.04198	0.40
Myrcianthes gigantea	Myrtaceae	1	31.25	0.34247	50%	0.01786	0.00701	0.03223	0.39
Myrcia hartwegiana	Myrtaceae	1	31.25	0.34247	50%	0.01786	0.00663	0.03050	0.39
Cupania vernalis	Sapindaceae	1	31.25	0.34247	50%	0.01786	0.00660	0.03033	0.39
Ocotea porosa	Lauraceae	1	31.25	0.34247	50%	0.01786	0.00565	0.02599	0.39
Myrsine coriacea	Myrsinaceae	1	31.25	0.34247	50%	0.01786	0.00497	0.02284	0.38
Siphoneugena reitzii	Myrtaceae	1	31.25	0.34247	50%	0.01786	0.00301	0.01382	0.37
Cestrum strigilatum	Solanaceae	1	31.25	0.34247	50%	0.01786	0.00276	0.01269	0.37

Erythroxylum deciduum	Erythroxylaceae	1	31.25	0.34247	50%	0.01786	0.00267	0.01229	0.37
Schinus terebinthifolius	Anacardiaceae	1	31.25	0.34247	50%	0.01786	0.00209	0.00959	0.37
Gochnatia polymorpha	Asteraceae	1	31.25	0.34247	50%	0.01786	0.00048	0.00221	0.36
Matayba elaegnoides	Sapindaceae	1	31.25	0.34247	50%	0.01786	0.00048	0.00221	0.36
Cinnamodendron dinisii	Canellaceae	1	31.25	0.34247	50%	0.01786	0.00025	0.00113	0.36
Calliandra tweediei	Mimosaceae	1	31.25	0.34247	50%	0.01786	0.00016	0.00072	0.36
Piptocarpha angustifolia	Asteraceae	1	31.25	0.34247	50%	0.01786	0.00006	0.00028	0.36
Maytenus ilicifolia	Celastraceae	1	31.25	0.34247	50%	0.01786	0.00000	0.00000	0.36
TOTAL	23	292	9125	100	2800	1	21.75	100	201

A4.6. Phytosociological data for the ecotope *Caíva* C from the rural community of Campininha, Três Barras, Santa Catarina, Brazil.

Taxonomic Species	**Taxonomic Family**	**N**	**DA (N/ha)**	**DR**	**FA (%)**	**FR**	**DoA (m2/ha)**	**DoR**	**IVI**
Ilex paraguariensis	Aquifoliaceae	135	2812.5	29.4117	100%	0.03125	0.52454	3.25920	32.70
Matayba elaegnoides	Sapindaceae	32	666.67	6.97168	100%	0.03125	2.98234	18.5307	25.53
Vernonanthura discolor	Asteraceae	13	270.83	2.83224	100%	0.03125	2.05947	12.7965	15.66
Ocotea porosa	Lauraceae	10	208.33	2.17865	100%	0.03125	2.04383	12.6993	14.91
Araucaria angustifolia	Araucariaceae	10	208.33	2.17865	100%	0.03125	1.93085	11.9974	14.21

Curitiba prismatica	Myrtaceae	43	895.83	9.36819	100%	0.03125	0.33678	2.09257	11.49
Nectandra lanceolata	Lauraceae	6	125.00	1.30719	100%	0.03125	1.58687	9.86002	11.20
Casearia sylvestris	Salicaceae	30	625.00	6.53595	100%	0.03125	0.13922	0.86502	7.43
Myrcia splendens	Myrtaceae	16	333.33	3.48584	66.67%	0.02084	0.44736	2.77970	6.29
Not identified	Not identified	20	416.67	4.35730	100%	0.03125	0.19940	1.23900	5.63
Rhamnus sphaerosperma	Rhamnaceae	17	354.17	3.70370	66.67%	0.02084	0.16031	0.99608	4.72
Cupania vernalis	Sapindaceae	8	166.67	1.74292	66.67%	0.02084	0.44543	2.76768	4.53
Cedrela fissilis	Meliaceae	1	20.83	0.21786	33.33%	0.01042	0.59860	3.71942	3.95
Ocotea diospyrifolia	Lauraceae	2	41.67	0.43573	66.67%	0.02084	0.52386	3.25502	3.71
Drimys brasiliensis	Winteraceae	2	41.67	0.43573	33.33%	0.01042	0.37581	2.33511	2.78
Campomanesia xanthocarpa	Myrtaceae	10	208.33	2.17865	66.67%	0.02084	0.07453	0.46307	2.66
Campomanesia rhombea	Myrtaceae	6	125.00	1.30719	66.67%	0.02084	0.20476	1.27228	2.60
Casearia decandra	Salicaceae	8	166.67	1.74292	66.67%	0.02084	0.09488	0.58951	2.35
Zanthoxylum fagara	Rutaceae	7	145.83	1.52505	100%	0.03125	0.08620	0.53560	2.09
Lonchocarpus muehlbergianus	Fabaceae	7	145.83	1.52505	66.67%	0.02084	0.00739	0.04594	1.59
Jacaranda puberula	Bignoniaceae	6	125.00	1.30719	66.67%	0.02084	0.02399	0.14905	1.48
Guazuma ulmifolia	Malvaceae	4	83.33	0.87146	33.33%	0.01042	0.09479	0.58899	1.47
Trichilia elegans	Meliaceae	5	104.17	1.08932	33.33%	0.01042	0.04902	0.30457	1.40
Sebastiania brasiliensis	Euphorbiaceae	5	104.17	1.08932	33.33%	0.01042	0.01801	0.11192	1.21

Allophylus edulis	Sapindaceae	5	104.17	1.08932	66.67%	0.02084	0.00571	0.03549	1.15
Myrsine umbellata	Myrsinaceae	2	41.67	0.43573	33.33%	0.01042	0.10831	0.67301	1.12
Clethra scabra	Clethraceae	1	20.83	0.21786	33.33%	0.01042	0.13944	0.86642	1.09
Persea major	Lauraceae	1	20.83	0.21786	33.33%	0.01042	0.13754	0.85460	1.08
Annona neosalicifolia	Annonaceae	3	62.50	0.65359	100%	0.03125	0.06190	0.38462	1.07
Cinnamomum amoenum	Lauraceae	2	41.67	0.43573	33.33%	0.01042	0.09291	0.57727	1.02
Roupala brasiliensis	Proteaceae	2	41.67	0.43573	33.33%	0.01042	0.08226	0.51110	0.96
Annona sylvatica	Annonaceae	4	83.33	0.87146	33.33%	0.01042	0.00210	0.01303	0.89
Ocotea silvestris	Lauraceae	1	20.83	0.21786	33.33%	0.01042	0.10221	0.63510	0.86
Ilex brevicuspis	Aquifoliaceae	3	62.50	0.65359	33.33%	0.01042	0.02042	0.12686	0.79
Dalbergia frutescens	Fabaceae	2	41.67	0.43573	33.33%	0.01042	0.05287	0.32853	0.77
Ocotea pulchella	Lauraceae	1	20.83	0.21786	33.33%	0.01042	0.06607	0.41054	0.64
Ocotea puberula	Lauraceae	1	20.83	0.21786	33.33%	0.01042	0.06476	0.40241	0.63
Rhynchosia sp	Fabaceae	1	20.83	0.21786	33.33%	0.01042	0.05050	0.31380	0.54
Eugenia hiemalis	Myrtaceae	1	20.83	0.21786	33.33%	0.01042	0.04134	0.25690	0.49
Casearia obliqua	Salicaceae	2	41.67	0.43573	33.33%	0.01042	0.00468	0.02907	0.48
Zanthoxylum rhoifolium	Rutaceae	2	41.67	0.43573	66.67%	0.02084	0.00151	0.00940	0.47
Ocotea catharinenses	Lauraceae	2	41.67	0.43573	66.67%	0.02084	0.00136	0.00846	0.47
Ocotea nutans	Lauraceae	1	20.83	0.21786	33.33%	0.01042	0.01701	0.10572	0.33
Eugenia pluriflora	Myrtaceae	1	20.83	0.21786	33.33%	0.01042	0.01210	0.07516	0.30

Sapium glandulosum	Euphorbiaceae	1	20.83	0.21786	33.33%	0.01042	0.00495	0.03074	0.26
Machaerium paraguariense	Fabaceae	1	20.83	0.21786	33.33%	0.01042	0.00331	0.02058	0.25
Eugenia uniflora	Myrtaceae	1	20.83	0.21786	33.33%	0.01042	0.00200	0.01245	0.24
Dendropanax cuneatus	Araliaceae	1	20.83	0.21786	33.33%	0.01042	0.00167	0.01041	0.24
Blepharocalyx salicifolius	Myrtaceae	1	20.83	0.21786	33.33%	0.01042	0.00157	0.00977	0.24
Celtis iguanea	Cannabaceae	1	20.83	0.21786	33.33%	0.01042	0.00102	0.00635	0.23
Celtis ehrenbergiana	Cannabaceae	1	20.83	0.21786	33.33%	0.01042	0.00094	0.00585	0.23
Xylosma pseudosalzmannii	Salicaceae	1	20.83	0.21786	33.33%	0.01042	0.00094	0.00585	0.23
Myrcia multiflora	Myrtaceae	1	20.83	0.21786	33.33%	0.01042	0.00092	0.00571	0.23
Duranta vestita	Verbenaceae	1	20.83	0.21786	33.33%	0.01042	0.00092	0.00570	0.23
Mollinedia schottiana	Monimiaceae	1	20.83	0.21786	33.33%	0.01042	0.00074	0.00457	0.23
Myrsine coriacea	Myrsinaceae	1	20.83	0.21786	33.33%	0.01042	0.00059	0.00367	0.23
Annona sp	Annonaceae	1	20.83	0.21786	33.33%	0.01042	0.00047	0.00294	0.23
Cinnamodendron dinisii	Canellaceae	1	20.83	0.21786	33.33%	0.01042	0.00047	0.00294	0.23
Schinus terebinthifolius	Anacardiaceae	1	20.83	0.21786	33.33%	0.01042	0.00024	0.00146	0.23
Mimosa scabrella	Fabaceae	1	20.83	0.21786	33.33%	0.01042	0.00013	0.00082	0.23
Miconia discolor	Melastomataceae	1	20.83	0.21786	33.33%	0.01042	0.00010	0.00065	0.23
Miconia cinerascens	Melastomataceae	1	20.83	0.21786	33.33%	0.01042	0.00007	0.00042	0.23
TOTAL	26	459	9562.5	100	3199.9	1	16.09	100	201

A4.7. Phytosociological data for the ecotope *Caíva* D from the rural community of Colônia Escada, Irineopolis, Santa Catarina, Brazil.

Taxonomic Species	Taxonomic Family	N	DA N/ha	DR	FA %	FR	DoA (m2/ha)	DoR	IVI
Ilex paraguariensis	Aquifoliaceae	537	3356.3	57.0064	100%	0.01667	3.64466	15.50515	72.53
Matayba elaegnoides	Sapindaceae	77	481.25	8.17410	100%	0.01667	4.70454	20.01412	28.20
Ocotea puberula	Lauraceae	8	50.00	0.84926	100%	0.01667	2.95043	12.55175	13.42
Sebastiania commersoniana	Euphorbiaceae	20	125.00	2.12314	100%	0.01667	1.48825	6.33134	8.47
Clethra scabra	Clethraceae	22	137.50	2.33546	100%	0.01667	0.94487	4.01966	6.37
Casearia decandra	Salicaceae	25	156.25	2.65393	100%	0.01667	0.75598	3.21610	5.89
Prunus myrtifolia	Rosaceae	5	31.25	0.53079	100%	0.01667	1.11031	4.72349	5.27
Ocotea porosa	Lauraceae	10	62.50	1.06157	100%	0.01667	0.88489	3.76452	4.84
Jacaranda puberula	Bignoniaceae	9	56.25	0.95541	100%	0.01667	0.71115	3.02537	4.00
Myrsine coriacea	Myrsinaceae	2	12.50	0.21231	100%	0.01667	0.82523	3.51071	3.74
Vernonanthura discolor	Asteraceae	8	50.00	0.84926	100%	0.01667	0.66443	2.82664	3.69
Curitiba prismatica	Myrtaceae	25	156.25	2.65393	100%	0.01667	0.22694	0.96545	3.64
Zanthoxylum fagara	Rutaceae	29	181.25	3.07856	100%	0.01667	0.04386	0.18658	3.28
Ilex theezans	Aquifoliaceae	5	31.25	0.53079	100%	0.01667	0.50599	2.15258	2.70
Luehea divaricata	Malvaceae	4	25.00	0.42463	100%	0.01667	0.46744	1.98858	2.43

Lonchocarpus muehlbergianus	Fabaceae	14	87.50	1.48620	100%	0.01667	0.17647	0.75073	2.25
Ilex dumosa	Aquifoliaceae	4	25.00	0.42463	100%	0.01667	0.39924	1.69846	2.14
Aegiphila integrifolia	Verbenaceae	3	18.75	0.31847	100%	0.01667	0.37156	1.58068	1.92
Myrcia splendens	Myrtaceae	13	81.25	1.38004	100%	0.01667	0.11651	0.49567	1.89
Piptocarpha angustifolia	Asteraceae	1	6.25	0.10616	100%	0.01667	0.38465	1.63638	1.76
Annona sylvatica	Annonaceae	14	87.50	1.48620	100%	0.01667	0.06008	0.25558	1.76
Machaerium paraguariense	Fabaceae	3	18.75	0.31847	100%	0.01667	0.32397	1.37826	1.71
Tibouchina sellowiana	Melastomataceae	15	93.75	1.59236	100%	0.01667	0.01944	0.08270	1.69
Ilex brevicuspis	Aquifoliaceae	5	31.25	0.53079	100%	0.01667	0.26488	1.12687	1.67
Vitex megapotamica	Lamiaceae	1	6.25	0.10616	100%	0.01667	0.31444	1.33768	1.46
Schinus terebinthifolius	Anacardiaceae	6	37.50	0.63694	100%	0.01667	0.16742	0.71224	1.37
Allophylus edulis	Sapindaceae	6	37.50	0.63694	100%	0.01667	0.13584	0.57789	1.23
Miconia sp	Melastomataceae	7	43.75	0.74310	100%	0.01667	0.01954	0.08311	0.84
Myrsine umbellata	Myrsinaceae	2	12.50	0.21231	100%	0.01667	0.12883	0.54808	0.78
Solanum pseudoquina	Solanaceae	7	43.75	0.74310	100%	0.01667	0.00267	0.01138	0.77
Lamanonia ternata	Cunoniaceae	2	12.50	0.21231	100%	0.01667	0.12311	0.52373	0.75
Gochnatia polymorpha	Asteraceae	1	6.25	0.10616	100%	0.01667	0.13595	0.57835	0.70
Sapium glandulosum	Euphorbiaceae	2	12.50	0.21231	100%	0.01667	0.08370	0.35606	0.59
Casearia sylvestris	Salicaceae	5	31.25	0.53079	100%	0.01667	0.00393	0.01670	0.56

Araucaria angustifolia	Araucariaceae	3	18.75	0.31847	100%	0.01667	0.03382	0.14387	0.48
Nao identificado	Nao identificado	3	18.75	0.31847	100%	0.01667	0.03257	0.13855	0.47
Miconia sellowiana	Melastomataceae	4	25.00	0.42463	100%	0.01667	0.00100	0.00424	0.45
Solanum variabile	Solanaceae	3	18.75	0.31847	100%	0.01667	0.02119	0.09013	0.43
Roupala brasiliensis	Proteaceae	3	18.75	0.31847	100%	0.01667	0.01189	0.05057	0.39
Piptocarpha axillaris	Asteraceae	1	6.25	0.10616	100%	0.01667	0.06154	0.26182	0.38
Baccharis microdonta	Asteraceae	3	18.75	0.31847	100%	0.01667	0.00377	0.01605	0.35
Campomanesia xanthocarpa	Myrtaceae	2	12.50	0.21231	100%	0.01667	0.02043	0.08693	0.32
Myrcia laruotteana	Myrtaceae	2	12.50	0.21231	100%	0.01667	0.01780	0.07575	0.30
Cinnamomum sellowianum	Lauraceae	2	12.50	0.21231	100%	0.01667	0.01423	0.06053	0.29
Cordyline spectabilis	Asparagaceae	1	6.25	0.10616	100%	0.01667	0.03380	0.14379	0.27
Solanum sanctaecatharinae	Solanaceae	1	6.25	0.10616	100%	0.01667	0.03157	0.13429	0.26
Casearia lasiophylla	Salicaceae	2	12.50	0.21231	100%	0.01667	0.00501	0.02131	0.25
Cestrum strigilatum	Solanaceae	2	12.50	0.21231	100%	0.01667	0.00248	0.01054	0.24
Sloanea guianensis	Elaeocarpaceae	2	12.50	0.21231	100%	0.01667	0.00042	0.00180	0.23
Erythroxylum argentinum	Erythroxylaceae	1	6.25	0.10616	100%	0.01667	0.01708	0.07266	0.20
Ilex microdonta	Aquifoliaceae	1	6.25	0.10616	100%	0.01667	0.01227	0.05218	0.18
Nectandra megapotamica	Lauraceae	1	6.25	0.10616	100%	0.01667	0.00907	0.03859	0.16
Persea major	Lauraceae	1	6.25	0.10616	100%	0.01667	0.00672	0.02857	0.15

Myrcia hartwegiana	Myrtaceae	1	6.25	0.10616	100%	0.01667	0.00442	0.01879	0.14
Myrcia guianensis	Myrtaceae	1	6.25	0.10616	100%	0.01667	0.00142	0.00603	0.13
Lycianthes rantonnei	Solanaceae	1	6.25	0.10616	100%	0.01667	0.00096	0.00409	0.13
Mimosa scabrella	Fabaceae	1	6.25	0.10616	100%	0.01667	0.00096	0.00409	0.13
Dendropanax cuneatus	Araliaceae	1	6.25	0.10616	100%	0.01667	0.00018	0.00075	0.12
Ocotea lanata	Lauraceae	1	6.25	0.10616	100%	0.01667	0.00012	0.00052	0.12
TOTAL	27	942	5887.5	100	6000	1	23.51	100	201

A4.8. Phytosociological data for the ecotope *Caíva* E from the rural community of Colônia Escada, Irineopolis, Santa Catarina, Brazil.

Taxonomic Species	**Taxonomic Family**	**N**	**DA N/ha**	**DR**	**FA %**	**FR**	**DoA (m2/ha)**	**DoR**	**IVI**
Curitiba prismatica	Myrtaceae	719	2246.9	35.0219	100%	0.01786	4.40559	17.09873	52.14
Araucaria angustifolia	Araucariaceae	272	850.00	13.2489	100%	0.01786	8.38930	32.56010	45.83
Myrcia splendens	Myrtaceae	171	534.38	8.32927	100%	0.01786	1.39886	5.42918	13.78
Ilex paraguariensis	Aquifoliaceae	97	303.13	4.72479	100%	0.01786	2.16585	8.40597	13.15
Casearia decandra	Salicaceae	120	375.00	5.84510	100%	0.01786	0.62203	2.41420	8.28
Matayba elaegnoides	Sapindaceae	10	31.25	0.48709	100%	0.01786	1.12209	4.35498	4.86
Casearia sylvestris	Salicaceae	47	146.88	2.28933	100%	0.01786	0.42597	1.65323	3.96
Tibouchina sellowiana	Melastomataceae	33	103.13	1.60740	100%	0.01786	0.58254	2.26091	3.89

Myrcia hartwegiana	Myrtaceae	70	218.75	3.40964	100%	0.01786	0.11042	0.42856	3.86
Myrsine coriacea	Myrsinaceae	17	53.13	0.82806	100%	0.01786	0.53296	2.06848	2.91
Sapium glandulosum	Euphorbiaceae	34	106.25	1.65611	100%	0.01786	0.31593	1.22617	2.90
Cedrela fissilis	Meliaceae	2	6.25	0.09742	100%	0.01786	0.71345	2.76901	2.88
Lamanonia ternata	Cunoniaceae	4	12.50	0.19484	100%	0.01786	0.64778	2.51414	2.73
Ocotea porosa	Lauraceae	4	12.50	0.19484	50%	0.00893	0.56530	2.19399	2.40
Ilex theezans	Aquifoliaceae	39	121.88	1.89966	100%	0.01786	0.09217	0.35772	2.28
Zanthoxylum kleinii	Rutaceae	38	118.75	1.85095	100%	0.01786	0.09621	0.37339	2.24
Myrsine umbellata	Myrsinaceae	39	121.88	1.89966	100%	0.01786	0.04174	0.16199	2.08
Nectandra megapotamica	Lauraceae	8	25.00	0.38967	100%	0.01786	0.42797	1.66100	2.07
Allophylus edulis	Sapindaceae	20	62.50	0.97418	100%	0.01786	0.26028	1.01017	2.00
Casearia lasiophylla	Salicaceae	26	81.25	1.26644	100%	0.01786	0.15263	0.59237	1.88
Ocotea puberula	Lauraceae	10	31.25	0.48709	100%	0.01786	0.28014	1.08727	1.59
Sloanea monosperma	Elaeocarpaceae	1	3.13	0.04871	50%	0.00893	0.39250	1.52335	1.58
Cinnamomum amoenum	Lauraceae	19	59.38	0.92547	100%	0.01786	0.14934	0.57962	1.52
Roupala brasiliensis	Proteaceae	6	18.75	0.29226	100%	0.01786	0.26628	1.03348	1.34
Annona sylvatica	Annonaceae	25	78.13	1.21773	100%	0.01786	0.02576	0.09997	1.34
Picramnia parvifolia	Picramniaceae	8	25.00	0.38967	100%	0.01786	0.18067	0.70122	1.11
Myrcianthes gigantea	Myrtaceae	15	46.88	0.73064	100%	0.01786	0.05431	0.21077	0.96

Machaerium paraguariense	Fabaceae	3	9.38	0.14613	50%	0.00893	0.20240	0.78554	0.94
Psidium cattleianum	Myrtaceae	13	40.63	0.63322	100%	0.01786	0.07275	0.28234	0.93
Campomanesia xanthocarpa	Myrtaceae	7	21.88	0.34096	100%	0.01786	0.13464	0.52258	0.88
Coussarea contracta	Rubiaceae	15	46.88	0.73064	100%	0.01786	0.02469	0.09583	0.84
Nao identificado	Nao identificado	13	40.63	0.63322	100%	0.01786	0.04819	0.18702	0.84
Lonchocarpus muehlbergianus	Fabaceae	15	46.88	0.73064	100%	0.01786	0.01393	0.05405	0.80
Drimys brasiliensis	Winteraceae	3	9.38	0.14613	50%	0.00893	0.16455	0.63865	0.79
Jacaranda puberula	Bignoniaceae	11	34.38	0.53580	100%	0.01786	0.05320	0.20649	0.76
Clethra scabra	Clethraceae	11	34.38	0.53580	100%	0.01786	0.05307	0.20597	0.76
Erythroxylum argentinum	Erythroxylaceae	7	21.88	0.34096	100%	0.01786	0.09090	0.35280	0.71
Schinus terebinthifolius	Anacardiaceae	10	31.25	0.48709	100%	0.01786	0.04652	0.18055	0.69
Vernonanthura discolor	Asteraceae	4	12.50	0.19484	100%	0.01786	0.11777	0.45710	0.67
Ilex brevicuspis	Aquifoliaceae	12	37.50	0.58451	100%	0.01786	0.01209	0.04694	0.65
Sebastiania commersoniana	Euphorbiaceae	1	3.13	0.04871	50%	0.00893	0.14966	0.58086	0.64
Prunus myrtifolia	Rosaceae	10	31.25	0.48709	100%	0.01786	0.02173	0.08436	0.59
Cinnamomum sellowianum	Lauraceae	9	28.13	0.43838	100%	0.01786	0.01786	0.06931	0.53
Miconia sellowiana	Melastomataceae	7	21.88	0.34096	100%	0.01786	0.00468	0.01818	0.38
Miconia sp	Melastomataceae	7	21.88	0.34096	50%	0.00893	0.00285	0.01106	0.36

Blepharocalyx salicifolius	Myrtaceae	1	3.13	0.04871	50%	0.00893	0.05301	0.20574	0.26
Symplocos tenuifolia	Symplocaceae	3	9.38	0.14613	100%	0.01786	0.01489	0.05778	0.22
Sloanea guianensis	Elaeocarpaceae	4	12.50	0.19484	50%	0.00893	0.00122	0.00472	0.21
Randia ferox	Rubiaceae	3	9.38	0.14613	50%	0.00893	0.00156	0.00606	0.16
Aegiphila integrifolia	Verbenaceae	3	9.38	0.14613	50%	0.00893	0.00115	0.00447	0.16
Lithrea brasiliensis	Anacardiaceae	2	6.25	0.09742	100%	0.01786	0.00685	0.02660	0.14
Casearia obliqua	Salicaceae	1	3.13	0.04871	50%	0.00893	0.01857	0.07206	0.13
Annona neosalicifolia	Annonaceae	2	6.25	0.09742	50%	0.00893	0.00356	0.01381	0.12
Ocotea diospyrifolia	Lauraceae	2	6.25	0.09742	50%	0.00893	0.00330	0.01281	0.12
Ilex dumosa	Aquifoliaceae	2	6.25	0.09742	50%	0.00893	0.00095	0.00368	0.11
Dendropanax cuneatus	Araliaceae	2	6.25	0.09742	50%	0.00893	0.00091	0.00351	0.11
Mollinedia schottiana	Monimiaceae	2	6.25	0.09742	50%	0.00893	0.00031	0.00122	0.11
Calliandra tweediei	Mimosaceae	1	3.13	0.04871	50%	0.00893	0.00374	0.01452	0.07
Baccharis microdonta	Asteraceae	1	3.13	0.04871	50%	0.00893	0.00153	0.00595	0.06
Calyptranthes concinna	Myrtaceae	1	3.13	0.04871	50%	0.00893	0.00153	0.00595	0.06
Rhynchosia sp	Fabaceae	1	3.13	0.04871	50%	0.00893	0.00071	0.00275	0.06
Campomanesia rhombea	Myrtaceae	1	3.13	0.04871	50%	0.00893	0.00063	0.00244	0.06
Maytenus boaria	Celastraceae	1	3.13	0.04871	50%	0.00893	0.00055	0.00214	0.06
Solanum variabile	Solanaceae	1	3.13	0.04871	50%	0.00893	0.00030	0.00115	0.06

Cestrum intermedium	Solanaceae	1	3.13	0.04871	50%	0.00893	0.00012	0.00047	0.06
Maytenus muelleri	Celastraceae	1	3.13	0.04871	50%	0.00893	0.00012	0.00047	0.06
Miconia hyemalis	Melastomataceae	1	3.13	0.04871	50%	0.00893	0.00012	0.00047	0.06
Myrcia laruotteana	Myrtaceae	1	3.13	0.04871	50%	0.00893	0.00012	0.00047	0.06
Piptocarpha tomentosa	Asteraceae	1	3.13	0.04871	50%	0.00893	0.00009	0.00034	0.06
Myrcia glabra	Myrtaceae	1	3.13	0.04871	50%	0.00893	0.00006	0.00024	0.06
TOTAL	32	2053	6415.6	100	5600	1	25.77	100	201

A4.9. Phytosociological data for the ecotope Mato from the rural community of Colônia Escada, Irineopolis, Santa Catarina, Brazil.

Taxonomic Species	**Taxonomic Family**	**N**	**DA N/ha**	**DR**	**FA %**	**FR**	**DoA (m2/ha)**	**DoR**	**IVI**
Prunus myrtifolia	Rosaceae	93	290.63	4.69934	100%	0.01415	5.81779	22.6477	27.36
Curitiba prismatica	Myrtaceae	348	1087.5	17.5846	100%	0.01415	1.07074	4.16819	21.77
Cinnamomum amoenum	Lauraceae	67	209.38	3.38555	100%	0.01415	3.53868	13.7755	17.18
Ilex paraguariensis	Aquifoliaceae	305	953.13	15.4118	100%	0.01415	0.43337	1.68702	17.11
Casearia sylvestris	Salicaceae	222	693.75	11.2178	100%	0.01415	0.75100	2.92353	14.16
Zanthoxylum kleinii	Rutaceae	174	543.75	8.79232	100%	0.01415	0.48144	1.87416	10.68
Araucaria angustifolia	Araucariaceae	88	275	4.44669	100%	0.01415	1.54274	6.00562	10.47

Vernonanthura discolor	Asteraceae	31	96.875	1.56645	100%	0.01415	2.25390	8.77407	10.35
Clethra scabra	Clethraceae	23	71.875	1.16220	100%	0.01415	1.80875	7.04115	8.22
Ilex theezans	Aquifoliaceae	81	253.13	4.09298	100%	0.01415	0.48643	1.89359	6.00
Casearia decandra	Salicaceae	68	212.5	3.43608	100%	0.01415	0.42639	1.65985	5.11
Cinnamomum sellowianum	Lauraceae	22	68.75	1.11167	66.67%	0.00943	0.87756	3.41621	4.54
Myrsine coriacea	Myrsinaceae	12	37.5	0.60637	100%	0.01415	0.98786	3.84556	4.47
Matayba elaegnoides	Sapindaceae	56	175	2.82971	100%	0.01415	0.41151	1.60195	4.45
Arecastrum romanzoffianum	Arecaceae	3	9.375	0.15159	66.67%	0.00943	0.68815	2.67885	2.84
Ocotea porosa	Lauraceae	21	65.625	1.06114	66.67%	0.00943	0.43912	1.70943	2.78
Allophylus edulis	Sapindaceae	30	93.75	1.51592	100%	0.01415	0.24863	0.96787	2.50
Persea major	Lauraceae	2	6.25	0.10106	100%	0.01415	0.59768	2.32667	2.44
Mimosa scabrella	Fabaceae	3	9.375	0.15159	66.67%	0.00943	0.54736	2.13076	2.29
Tibouchina sellowiana	Melastomataceae	38	118.75	1.92016	100%	0.01415	0.02961	0.11526	2.05
Myrcia hartwegiana	Myrtaceae	31	96.875	1.56645	100%	0.01415	0.07347	0.28602	1.87
Sebastiania commersoniana	Euphorbiaceae	20	62.5	1.01061	100%	0.01415	0.13949	0.54300	1.57
Myrsine umbellata	Myrsinaceae	17	53.125	0.85902	100%	0.01415	0.13070	0.50877	1.38
Machaerium paraguariense	Fabaceae	10	31.25	0.50531	100%	0.01415	0.15936	0.62035	1.14
Piptocarpha axillaris	Asteraceae	5	15.625	0.25265	100%	0.01415	0.22388	0.87152	1.14

Erythroxylum argentinum	Erythroxylaceae	16	50	0.80849	100%	0.01415	0.06638	0.25840	1.08
Sapium glandulosum	Euphorbiaceae	8	25	0.40424	100%	0.01415	0.14895	0.57983	1.00
Ilex brevicuspis	Aquifoliaceae	14	43.75	0.70743	100%	0.01415	0.04508	0.17550	0.90
Ocotea nutans	Lauraceae	7	21.875	0.35371	66.67%	0.00943	0.12494	0.48636	0.85
Cestrum strigilatum	Solanaceae	15	46.875	0.75796	100%	0.01415	0.00694	0.02703	0.80
Ocotea puberula	Lauraceae	2	6.25	0.10106	66.67%	0.00943	0.15175	0.59072	0.70
Ilex dumosa	Aquifoliaceae	5	15.625	0.25265	100%	0.01415	0.10111	0.39362	0.66
Myrcia splendens	Myrtaceae	11	34.375	0.55584	100%	0.01415	0.02053	0.07992	0.65
Celtis ehrenbergiana	Cannabaceae	7	21.875	0.35371	100%	0.01415	0.07090	0.27598	0.64
Casearia lasiophylla	Salicaceae	8	25	0.40424	100%	0.01415	0.03679	0.14322	0.56
Nao identificado	Nao identificado	8	25	0.40424	100%	0.01415	0.02912	0.11336	0.53
Styrax leprosus	Styracaceae	3	9.375	0.15159	100%	0.01415	0.09290	0.36164	0.53
Ocotea bicolor	Lauraceae	4	12.5	0.20212	66.67%	0.00943	0.08069	0.31411	0.53
Casearia obliqua	Salicaceae	2	6.25	0.10106	66.67%	0.00943	0.09030	0.35152	0.46
Maytenus boaria	Celastraceae	3	9.375	0.15159	66.67%	0.00943	0.07656	0.29805	0.46
Aegiphila integrifolia	Verbenaceae	2	6.25	0.10106	100%	0.01415	0.08549	0.33279	0.45
Jacaranda puberula	Bignoniaceae	3	9.375	0.15159	100%	0.01415	0.06125	0.23844	0.40
Myrcia laruotteana	Myrtaceae	7	21.875	0.35371	100%	0.01415	0.00709	0.02762	0.40
Campomanesia xanthocarpa	Myrtaceae	6	18.75	0.30318	100%	0.01415	0.01947	0.07579	0.39

Myrcia glabra	Myrtaceae	7	21.875	0.35371	66.67%	0.00943	0.00444	0.01727	0.38
Mollinedia schottiana	Monimiaceae	7	21.875	0.35371	66.67%	0.00943	0.00114	0.00445	0.37
Nectandra megapotamica	Lauraceae	5	15.625	0.25265	100%	0.01415	0.01896	0.07380	0.34
Drimys brasiliensis	Winteraceae	5	15.625	0.25265	66.67%	0.00943	0.00533	0.02073	0.28
Annona sylvatica	Annonaceae	4	12.5	0.20212	100%	0.01415	0.01245	0.04845	0.26
Schinus terebinthifolius	Anacardiaceae	3	9.375	0.15159	66.67%	0.00943	0.02010	0.07824	0.24
Randia ferox	Rubiaceae	4	12.5	0.20212	100%	0.01415	0.00405	0.01576	0.23
Ocotea teleiandra	Lauraceae	1	3.125	0.05053	66.67%	0.00943	0.03833	0.14921	0.21
Lithrea brasiliensis	Anacardiaceae	3	9.375	0.15159	66.67%	0.00943	0.00582	0.02264	0.18
Solanum pseudoquina	Solanaceae	3	9.375	0.15159	66.67%	0.00943	0.00383	0.01491	0.18
Ilex microdonta	Aquifoliaceae	2	6.25	0.10106	100%	0.01415	0.01458	0.05677	0.17
Lycianthes rantonnei	Solanaceae	2	6.25	0.10106	66.67%	0.00943	0.00360	0.01403	0.12
Cinnamomum glaziovii	Lauraceae	1	3.125	0.05053	66.67%	0.00943	0.01454	0.05662	0.12
Neomitranthes cordifolia	Myrtaceae	2	6.25	0.10106	66.67%	0.00943	0.00083	0.00323	0.11
Ocotea diospyrifolia	Lauraceae	1	3.125	0.05053	66.67%	0.00943	0.00854	0.03324	0.09
Cordyline spectabilis	Asparagaceae	1	3.125	0.05053	66.67%	0.00943	0.00638	0.02484	0.08
Myrcia palustris	Myrtaceae	1	3.125	0.05053	66.67%	0.00943	0.00638	0.02484	0.08
Lonchocarpus muehlbergianus	Fabaceae	1	3.125	0.05053	66.67%	0.00943	0.00519	0.02021	0.08

Sebastiania serrata	Euphorbiaceae	1	3.125	0.05053	66.67%	0.00943	0.00497	0.01934	0.08
Myrcia hebepetala	Myrtaceae	1	3.125	0.05053	66.67%	0.00943	0.00433	0.01685	0.08
Ocotea pulchella	Lauraceae	1	3.125	0.05053	66.67%	0.00943	0.00412	0.01605	0.08
Symplocos pentandra	Symplocaceae	1	3.125	0.05053	66.67%	0.00943	0.00393	0.01528	0.08
Cyphomandra corymbiflora	Solanaceae	1	3.125	0.05053	66.67%	0.00943	0.00301	0.01170	0.07
Myrcia hatschbachii	Myrtaceae	1	3.125	0.05053	66.67%	0.00943	0.00275	0.01071	0.07
Psidium cattleianum	Myrtaceae	1	3.125	0.05053	66.67%	0.00943	0.00221	0.00859	0.07
Roupala brasiliensis	Proteaceae	1	3.125	0.05053	33.33%	0.00472	0.00284	0.01104	0.07
Citronella paniculata	Cardiopteridaceae	1	3.125	0.05053	66.67%	0.00943	0.00153	0.00597	0.07
Rhynchosia sp	Fabaceae	1	3.125	0.05053	66.67%	0.00943	0.00041	0.00161	0.06
Picramnia parvifolia	Picramniaceae	1	3.125	0.05053	66.67%	0.00943	0.00025	0.00095	0.06
Symplocos tetrandra	Symplocaceae	1	3.125	0.05053	66.67%	0.00943	0.00025	0.00095	0.06
Dalbergia frutescens	Fabaceae	1	3.125	0.05053	66.67%	0.00943	0.00024	0.00093	0.06
Mollinedia eugeniifolia	Monimiaceae	1	3.125	0.05053	66.67%	0.00943	0.00020	0.00077	0.06
Eugenia pyriformis	Myrtaceae	1	3.125	0.05053	66.67%	0.00943	0.00016	0.00061	0.06
Mollinedia elegans	Monimiaceae	1	3.125	0.05053	66.67%	0.00943	0.00016	0.00061	0.06
Eugenia uniflora	Myrtaceae	1	3.125	0.05053	66.67%	0.00943	0.00013	0.00050	0.06
Dendropanax cuneatus	Araliaceae	1	3.125	0.05053	66.67%	0.00943	0.00012	0.00047	0.06
Baccharis sp	Asteraceae	1	3.125	0.05053	66.67%	0.00943	0.00009	0.00034	0.06

Solanum sanctaecatharinae	Solanaceae	1	3.125	0.05053	66.67%	0.00943	0.00009	0.00034	0.06
Aureliana wettsteiniana	Solanaceae	1	3.125	0.05053	66.67%	0.00943	0.00006	0.00024	0.06
Blepharocalyx salicifolius	Myrtaceae	1	3.125	0.05053	66.67%	0.00943	0.00004	0.00015	0.06
Myrcia guianensis	Myrtaceae	1	3.125	0.05053	66.67%	0.00943	0.00003	0.00012	0.06
Nectandra angustifolia	Lauraceae	1	3.125	0.05053	66.67%	0.00943	0.00002	0.00009	0.06
Piptocarpha angustifolia	Asteraceae	1	3.125	0.05053	66.67%	0.00943	0.00002	0.00009	0.06
TOTAL	33	1979	6184.4	100	7066.8%	1	25.69	100	201

A4.10. Phytosociological data for the ecotope Mato Fechado from the rural community of Campininha, Três Barras, Santa Catarina, Brazil.

Taxonomic Species	**Taxonomic Family**	**N**	**DA (N/ha)**	**DR**	**FA %**	**FR**	**DoA (m2/ha)**	**DoR**	**IVI**
Araucaria angustifolia	Araucariaceae	170	354.17	8.07985	100%	0.01724	8.82771	34.0062	42.10
Curitiba prismatica	Myrtaceae	517	1077.1	24.5722	100%	0.01724	2.56505	9.88111	34.47
Matayba elaegnoides	Sapindaceae	114	237.50	5.41825	100%	0.01724	3.39179	13.0659	18.50
Campomanesia rhombea	Myrtaceae	156	325.00	7.41445	100%	0.01724	0.73328	2.82475	10.26

Mollinedia schottiana	Monimiaceae	32	66.67	1.52091	66.67%	0.01149	1.31596	5.06935	6.60
Clethra scabra	Clethraceae	54	112.50	2.56654	100%	0.01724	0.68822	2.65119	5.23
Myrcia splendens	Myrtaceae	79	164.58	3.75475	100%	0.01724	0.34045	1.31147	5.08
Ilex paraguariensis	Aquifoliaceae	75	156.25	3.56464	100%	0.01724	0.30745	1.18435	4.77
Myrcia hartwegiana	Myrtaceae	78	162.50	3.70722	100%	0.01724	0.22218	0.85589	4.58
Casearia decandra	Salicaceae	48	100.00	2.28137	100%	0.01724	0.52404	2.01872	4.32
Zanthoxylum fagara	Rutaceae	45	93.75	2.13878	100%	0.01724	0.55042	2.12032	4.28
Sebastiania commersoniana	Euphorbiaceae	39	81.25	1.85361	33.33%	0.00575	0.61200	2.35756	4.22
Gochnatia polymorpha	Asteraceae	21	43.75	0.99810	100%	0.01724	0.73023	2.81299	3.83
Ilex dumosa	Aquifoliaceae	48	100.00	2.28137	100%	0.01724	0.28704	1.10575	3.40
Myrsine umbellata	Myrsinaceae	51	106.25	2.42395	100%	0.01724	0.18938	0.72954	3.17
Cinnamomum amoenum	Lauraceae	33	68.75	1.56844	100%	0.01724	0.37486	1.44402	3.03
Vernonanthura discolor	Asteraceae	10	20.83	0.47529	100%	0.01724	0.59928	2.30855	2.80
Miconia discolor	Melastomataceae	53	110.42	2.51901	100%	0.01724	0.03330	0.12827	2.66
Ilex theezans	Aquifoliaceae	50	104.17	2.37643	100%	0.01724	0.06738	0.25957	2.65
Lithrea brasiliensis	Anacardiaceae	11	22.92	0.52281	100%	0.01724	0.42817	1.64938	2.19
Myrsine coriacea	Myrsinaceae	17	35.42	0.80798	100%	0.01724	0.35266	1.35853	2.18
Allophylus edulis	Sapindaceae	33	68.75	1.56844	100%	0.01724	0.14733	0.56755	2.15

Annona sylvatica	Annonaceae	31	64.58	1.47338	100%	0.01724	0.07540	0.29045	1.78
Zanthoxylum rhoifolium	Rutaceae	10	20.83	0.47529	66.67%	0.01149	0.29755	1.14622	1.63
Rhamnus sphaerosperma	Rhamnaceae	18	37.50	0.85551	100%	0.01724	0.19522	0.75205	1.62
Drimys brasiliensis	Winteraceae	16	33.33	0.76046	100%	0.01724	0.21973	0.84644	1.62
Eugenia pluriflora	Myrtaceae	5	10.42	0.23764	100%	0.01724	0.35279	1.35903	1.61
Ilex microdonta	Aquifoliaceae	4	8.33	0.19011	100%	0.01724	0.26320	1.01392	1.22
Ocotea pulchella	Lauraceae	9	18.75	0.42776	66.67%	0.01149	0.17505	0.67432	1.11
Lonchocarpus muehlbergianus	Fabaceae	20	41.67	0.95057	100%	0.01724	0.02979	0.11476	1.08
Campomanesia xanthocarpa	Myrtaceae	17	35.42	0.80798	100%	0.01724	0.05741	0.22116	1.05
Ocotea nutans	Lauraceae	11	22.92	0.52281	66.67%	0.01149	0.13099	0.50459	1.04
Miconia hyemalis	Melastomataceae	19	39.58	0.90304	33.33%	0.00575	0.02441	0.09405	1.00
Not identified	Not identified	9	18.75	0.42776	100%	0.01724	0.11227	0.43249	0.88
Maytenus ilicifolia	Celastraceae	16	33.33	0.76046	100%	0.01724	0.02134	0.08220	0.86
Ilex brevicuspis	Aquifoliaceae	14	29.17	0.66540	66.67%	0.01149	0.04390	0.16910	0.85
Ocotea catharinenses	Lauraceae	10	20.83	0.47529	66.67%	0.01149	0.08195	0.31569	0.80
Daphnopsis racemosa	Thymelaeaceae	15	31.25	0.71293	100%	0.01724	0.00175	0.00674	0.74
Erythroxylum argentinum	Erythroxylaceae	10	20.83	0.47529	100%	0.01724	0.05201	0.20034	0.69

Arecastrum romanzoffianum	Arecaceae	1	2.08	0.04753	33.33%	0.00575	0.12548	0.48339	0.54
Nectandra megapotamica	Lauraceae	10	20.83	0.47529	66.67%	0.01149	0.01116	0.04297	0.53
Casearia sylvestris	Salicaceae	6	12.50	0.28517	100%	0.01724	0.03594	0.13845	0.44
Nectandra lanceolata	Lauraceae	8	16.67	0.38023	66.67%	0.01149	0.00991	0.03817	0.43
Strychnos brasiliensis	Loganiaceae	7	14.58	0.33270	66.67%	0.01149	0.01860	0.07166	0.42
Prunus myrtifolia	Rosaceae	8	16.67	0.38023	66.67%	0.01149	0.00319	0.01228	0.40
Miconia ferrugem	Melastomataceae	7	14.58	0.33270	66.67%	0.01149	0.00396	0.01526	0.36
Xylosma pseudosalzmannii	Salicaceae	7	14.58	0.33270	66.67%	0.01149	0.00343	0.01322	0.36
Myrcia selloi	Myrtaceae	6	12.50	0.28517	100%	0.01724	0.00287	0.01105	0.31
Myrcia multiflora	Myrtaceae	6	12.50	0.28517	66.67%	0.01149	0.00122	0.00469	0.30
Cedrela fissilis	Meliaceae	1	2.08	0.04753	33.33%	0.00575	0.05477	0.21098	0.26
Aegiphila integrifolia	Verbenaceae	1	2.08	0.04753	33.33%	0.00575	0.05299	0.20412	0.26
Sapium glandulosum	Euphorbiaceae	2	4.17	0.09506	33.33%	0.00575	0.03928	0.15133	0.25
Jacaranda puberula	Bignoniaceae	3	6.25	0.14259	33.33%	0.00575	0.02476	0.09538	0.24
Ocotea puberula	Lauraceae	4	8.33	0.19011	33.33%	0.00575	0.00132	0.00510	0.20
Schinus terebinthifolius	Anacardiaceae	3	6.25	0.14259	33.33%	0.00575	0.01202	0.04629	0.19
Piptocarpha angustifolia	Asteraceae	1	2.08	0.04753	33.33%	0.00575	0.03251	0.12525	0.18
Condalia buxifolia	Rhamnaceae	2	4.17	0.09506	66.67%	0.01149	0.01644	0.06334	0.17

Eugenia uniflora	Myrtaceae	2	4.17	0.09506	66.67%	0.01149	0.01510	0.05819	0.16
Picramnia parvifolia	Picramniaceae	3	6.25	0.14259	66.67%	0.01149	0.00169	0.00652	0.16
Baccharis microdonta	Asteraceae	3	6.25	0.14259	66.67%	0.01149	0.00055	0.00213	0.16
Cyphomandra corymbiflora	Solanaceae	3	6.25	0.14259	33.33%	0.00575	0.00092	0.00353	0.15
Trichilia elegans	Meliaceae	3	6.25	0.14259	33.33%	0.00575	0.00050	0.00193	0.15
Miconia sp	Melastomataceae	3	6.25	0.14259	33.33%	0.00575	0.00025	0.00098	0.15
Piptocarpha tomentosa	Asteraceae	1	2.08	0.04753	33.33%	0.00575	0.02394	0.09224	0.15
Ocotea porosa	Lauraceae	2	4.17	0.09506	33.33%	0.00575	0.00832	0.03207	0.13
Cupania vernalis	Sapindaceae	2	4.17	0.09506	33.33%	0.00575	0.00287	0.01105	0.11
Myrcia palustris	Myrtaceae	2	4.17	0.09506	33.33%	0.00575	0.00278	0.01072	0.11
Persea major	Lauraceae	2	4.17	0.09506	66.67%	0.01149	0.00073	0.00283	0.11
Calliandra parvifolia	Mimosaceae	2	4.17	0.09506	33.33%	0.00575	0.00210	0.00809	0.11
Diatenopteryx sorbifolia	Sapindaceae	2	4.17	0.09506	33.33%	0.00575	0.00202	0.00777	0.11
Styrax leprosus	Styracaceae	2	4.17	0.09506	33.33%	0.00575	0.00188	0.00724	0.11
Solanum variabile	Solanaceae	2	4.17	0.09506	33.33%	0.00575	0.00113	0.00434	0.11
Myrceugenia euosma	Myrtaceae	2	4.17	0.09506	33.33%	0.00575	0.00007	0.00026	0.10
Blepharocalyx salicifolius	Myrtaceae	1	2.08	0.04753	33.33%	0.00575	0.00896	0.03450	0.09
Rhynchosia sp	Fabaceae	1	2.08	0.04753	33.33%	0.00575	0.00442	0.01704	0.07

Tibouchina sellowiana	Melastomataceae	1	2.08	0.04753	33.33%	0.00575	0.00123	0.00472	0.06
Erythroxylum deciduum	Erythroxylaceae	1	2.08	0.04753	33.33%	0.00575	0.00111	0.00426	0.06
Piptocarpha axillaris	Asteraceae	1	2.08	0.04753	33.33%	0.00575	0.00096	0.00369	0.06
Luehea divaricata	Malvaceae	1	2.08	0.04753	33.33%	0.00575	0.00087	0.00333	0.06
Holvenia dulcis	Rhamnaceae	1	2.08	0.04753	33.33%	0.00575	0.00065	0.00252	0.06
Stillingia oppositifolia	Euphorbiaceae	1	2.08	0.04753	33.33%	0.00575	0.00045	0.00174	0.06
Baccharis dentata	Asteraceae	1	2.08	0.04753	33.33%	0.00575	0.00020	0.00076	0.05
Ocotea diospyrifolia	Lauraceae	1	2.08	0.04753	33.33%	0.00575	0.00016	0.00063	0.05
Brunfelsia cuneifolia	Solanaceae	1	2.08	0.04753	33.33%	0.00575	0.00012	0.00045	0.05
Cinnamodendron dinisii	Canellaceae	1	2.08	0.04753	33.33%	0.00575	0.00006	0.00021	0.05
Dalbergia frutescens	Fabaceae	1	2.08	0.04753	33.33%	0.00575	0.00004	0.00016	0.05
Myrcia guianensis	Myrtaceae	1	2.08	0.04753	33.33%	0.00575	0.00003	0.00010	0.05
Cestrum strigilatum	Solanaceae	1	2.08	0.04753	33.33%	0.00575	0.00001	0.00006	0.05
TOTAL	33	2104	4383	100	5799.9	1	25.96	100	201

A4.11. Phytosociological data for the ecotope FLONA from National Forest of Três Barras, Três Barras, Santa Catarina, Brazil.

Taxonomic Species	Taxonomic Family	N	DA N/ha	DR	FA %	FR	DoA (m2/ha)	DoR	IVI
Araucaria angustifolia	Araucariaceae	84	175.00	2.85229	100%	0.02362	21.40248	64.18135	67.06
Vernonanthura discolor	Asteraceae	1182	2462.5	40.1358	100%	0.02362	2.68322	8.04639	48.21
Ilex paraguariensis	Aquifoliaceae	427	889.58	14.4992	100%	0.02362	0.28443	0.85293	15.38
Ilex brevicuspis	Aquifoliaceae	184	383.33	6.24788	100%	0.02362	0.18521	0.55541	6.83
Nao identificado	Nao identificado	111	231.25	3.76910	100%	0.02362	1.00167	3.00379	6.80
Baccharis semiserrata	Asteraceae	140	291.67	4.75382	100%	0.02362	0.33716	1.01108	5.79
Myrsine coriacea	Myrsinaceae	146	304.17	4.95756	100%	0.02362	0.16210	0.48609	5.47
Symplocos tetrandra	Symplocaceae	141	293.75	4.78778	100%	0.02362	0.12179	0.36522	5.18
Jacaranda puberula	Bignoniaceae	15	31.25	0.50934	66.67%	0.01575	1.54264	4.62604	5.15
Lithrea brasiliensis	Anacardiaceae	25	52.08	0.84890	66.67%	0.01575	1.02098	3.06171	3.93
Dicksonia sellowiana	Cyatheaceae	12	25.00	0.40747	100%	0.02362	0.85152	2.55353	2.98
Cinnamomum amoenum	Lauraceae	11	22.92	0.37351	66.67%	0.01575	0.79767	2.39204	2.78
Myrcia guianensis	Myrtaceae	55	114.58	1.86757	100%	0.02362	0.00026	0.00078	1.89
Matayba elaegnoides	Sapindaceae	8	16.67	0.27165	66.67%	0.01575	0.50267	1.50740	1.79

Solanum sanctaecatharinae	Solanaceae	42	87.50	1.42615	100%	0.02362	0.03721	0.11158	1.56
Clethra scabra	Clethraceae	12	25.00	0.40747	100%	0.02362	0.36137	1.08368	1.51
Miconia sp	Melastomataceae	42	87.50	1.42615	33.33%	0.00787	0.02310	0.06927	1.50
Miconia discolor	Melastomataceae	38	79.17	1.29032	66.67%	0.01575	0.01506	0.04515	1.35
Roupala asplenioides	Proteaceae	35	72.92	1.18846	66.67%	0.01575	0.02005	0.06012	1.26
Cupania vernalis	Sapindaceae	14	29.17	0.47538	66.67%	0.01575	0.25116	0.75317	1.24
Palicourea australis	Rubiaceae	31	64.58	1.05263	100%	0.02362	0.00407	0.01222	1.09
Myrcia sp.	Myrtaceae	12	25.00	0.40747	100%	0.02362	0.17910	0.53708	0.97
Sebastiania commersoniana	Euphorbiaceae	11	22.92	0.37351	100%	0.02362	0.15991	0.47954	0.88
Ilex theezans	Aquifoliaceae	23	47.92	0.78098	66.67%	0.01575	0.01149	0.03444	0.83
Drimys brasiliensis	Winteraceae	14	29.17	0.47538	100%	0.02362	0.08362	0.25075	0.75
Nectandra lanceolata	Lauraceae	19	39.58	0.64516	66.67%	0.01575	0.00210	0.00631	0.67
Ocotea porosa	Lauraceae	3	6.25	0.10187	66.67%	0.01575	0.17808	0.53402	0.65
Sebastiania serrata	Euphorbiaceae	1	2.08	0.03396	33.33%	0.00787	0.19297	0.57866	0.62
Nectandra sp.	Lauraceae	5	10.42	0.16978	33.33%	0.00787	0.14507	0.43504	0.61
Cedrela fissilis	Meliaceae	3	6.25	0.10187	66.67%	0.01575	0.14840	0.44501	0.56
Erythroxylum deciduum	Erythroxylaceae	1	2.08	0.03396	33.33%	0.00787	0.14474	0.43406	0.48
Myrcia laruotteana	Myrtaceae	1	2.08	0.03396	33.33%	0.00787	0.13227	0.39664	0.44

Piptocarpha angustifolia	Asteraceae	7	14.58	0.23769	33.33%	0.00787	0.02790	0.08367	0.33
Psidium cattleianum	Myrtaceae	1	2.08	0.03396	33.33%	0.00787	0.09342	0.28014	0.32
Roupala rhombifolia	Proteaceae	7	14.58	0.23769	100.00 %	0.02362	0.01414	0.04240	0.30
Ocotea puberula	Lauraceae	2	4.17	0.06791	33.33%	0.00787	0.05914	0.17736	0.25
Guazuma ulmifolia	Malvaceae	7	14.58	0.23769	33.33%	0.00787	0.00238	0.00713	0.25
Annona neosalicifolia	Annonaceae	5	10.42	0.16978	33.33%	0.00787	0.01413	0.04238	0.22
Arecastrum romanzoffianum	Arecaceae	1	2.08	0.03396	33.33%	0.00787	0.05904	0.17704	0.22
Luehea divaricata	Malvaceae	1	2.08	0.03396	33.33%	0.00787	0.05537	0.16604	0.21
Dalbergia frutescens	Fabaceae	5	10.42	0.16978	66.67%	0.01575	0.00031	0.00093	0.19
Prunus myrtifolia	Rosaceae	4	8.33	0.13582	66.67%	0.01575	0.00744	0.02230	0.17
Zanthoxylum kleinii	Rutaceae	4	8.33	0.13582	66.67%	0.01575	0.00203	0.00610	0.16
Quillaja brasiliensis	Rosaceae	4	8.33	0.13582	66.67%	0.01575	0.00119	0.00356	0.16
Curitiba prismatica	Myrtaceae	4	8.33	0.13582	66.67%	0.01575	0.00041	0.00122	0.15
Mimosa scabrella	Fabaceae	4	8.33	0.13582	33.33%	0.00787	0.00025	0.00076	0.14
Casearia decandra	Salicaceae	3	6.25	0.10187	66.67%	0.01575	0.00346	0.01036	0.13
Campomanesia xanthocarpa	Myrtaceae	3	6.25	0.10187	66.67%	0.01575	0.00083	0.00249	0.12
Solanum paranense	Solanaceae	3	6.25	0.10187	66.67%	0.01575	0.00073	0.00219	0.12
Hirtella hebeclada	Chrysobalanaceae	3	6.25	0.10187	33.33%	0.00787	0.00316	0.00948	0.12

Styrax leprosus	Styracaceae	3	6.25	0.10187	66.67%	0.01575	0.00019	0.00056	0.12
Zanthoxylum rhoifolium	Rutaceae	3	6.25	0.10187	33.33%	0.00787	0.00041	0.00122	0.11
Casearia sylvestris	Salicaceae	2	4.17	0.06791	66.67%	0.01575	0.00247	0.00740	0.09
Aureliana wettsteiniana	Solanaceae	2	4.17	0.06791	66.67%	0.01575	0.00138	0.00412	0.09
Solanum pabstii	Solanaceae	2	4.17	0.06791	33.33%	0.00787	0.00330	0.00990	0.09
Myrcia hartwegiana	Myrtaceae	2	4.17	0.06791	33.33%	0.00787	0.00008	0.00024	0.08
Ocotea pulchella	Lauraceae	1	2.08	0.03396	33.33%	0.00787	0.00734	0.02202	0.06
Ocotea silvestris	Lauraceae	1	2.08	0.03396	33.33%	0.00787	0.00072	0.00216	0.04
Maytenus cassineformis	Celastraceae	1	2.08	0.03396	33.33%	0.00787	0.00065	0.00196	0.04
Ocotea sp	Lauraceae	1	2.08	0.03396	33.33%	0.00787	0.00042	0.00126	0.04
Lycianthes rantonnei	Solanaceae	1	2.08	0.03396	33.33%	0.00787	0.00020	0.00059	0.04
Symplocos uniflora	Symplocaceae	1	2.08	0.03396	33.33%	0.00787	0.00020	0.00059	0.04
Calliandra parvifolia	Mimosaceae	1	2.08	0.03396	33.33%	0.00787	0.00016	0.00049	0.04
Ilex dumosa	Aquifoliaceae	1	2.08	0.03396	33.33%	0.00787	0.00013	0.00040	0.04
Maytenus boaria	Celastraceae	1	2.08	0.03396	33.33%	0.00787	0.00013	0.00040	0.04
Matayba guianensis	Sapindaceae	1	2.08	0.03396	33.33%	0.00787	0.00004	0.00012	0.04
Rudgea parquioides	Rubiaceae	1	2.08	0.03396	33.33%	0.00787	0.00004	0.00012	0.04
Strychnos brasiliensis	Loganiaceae	1	2.08	0.03396	33.33%	0.00787	0.00004	0.00012	0.04

Xylosma pseudosalzmannii	Salicaceae	1	2.08	0.03396	33.33%	0.00787	0.00004	0.00012	0.04
Campomanesia rhombea	Myrtaceae	1	2.08	0.03396	33.33%	0.00787	0.00003	0.00008	0.04
Schinus terebinthifolius	Anacardiaceae	1	2.08	0.03396	33.33%	0.00787	0.00003	0.00008	0.04
TOTAL	32	2945	6135.4	100	4233.3	1	33.35	100	201

APÊNDICE 5: Plant data for 11 ecotopes found in the communities of Campininha, Colônia Escada and the National Forest of Três Barras in the Northern Plateau of Santa Catarina, Brazil. Barb = Barbaqua; Taq = Taquaral; CA = *Caiva A*; CB = *Caiva B*; CC= *Caiva C*; CD = *Caiva D*; CE = *Caiva E*;

Botanical Family	Barb	Taq	Campo	CA	CB	CC	CD	CE	M	MF	FLONA
Anacardiaceae											
Lithrea brasiliensis Marchand	X	X	-	X	-	-	-	X	X	X	X
Schinus terebinthifolius Raddi	-	X	-	X	X	X	X	X	X	X	X
Annonaceae											
Annona neosalicifolia H. Rainer	-	X	-	-	-	X	-	X	-	-	X
Annona sylvatica A. St.-Hil.	-	-	-	-	X	X	X	X	X	X	-
Annona spp	-	-	-	-	-	X	-		-	-	-
Aquifoliaceae											
Ilex brevicuspis Reissek	-	-	-	X	X	X	X	X	X	X	X
Ilex dumosa Reissek	X	X	-	-	X	-	X	X	X	X	X
Ilex microdonta Reissek	-	-	-	-	-	-	X	-	X	X	-
Ilex paraguariensis A. St.-Hil.	X	X	X	X	X	X	X	X	X	X	X
Ilex theezans Mart. Ex Reissek	X	X	-	-	X	-	X	X	X	X	X
Araliaceae											
Dendropanax cuneatus (DC.) Decne. & Planch.	-	-	-	-	-	X	X	X	X	-	-
Araucariaceae											

Araucaria angustifolia (Bertol.) Kuntze.	X	X	X	X	X	X	X	X	X	X	X
Arecaceae											
Arecastrum romanzoffianum (Mart.) Becc.	X	-	-	-	X	-	-	-	X	X	X
Asparagaceae											
Cordyline spectabilis Kunth & Bouché	-	-	-	-	-	-	X	-	X	-	-
Asteraceae											
Baccharis dentata (Vell.) G. M. Barroso	-	-	-	-	-	-	-	-	-	X	
Baccharis microdonta DC.	-	-	-	-	-	-	X	X	-	X	
Baccharis semiserrata DC.	-	-	-	-	-	-	-	-	-	-	X
Baccharis spp	X	-	-	X	-	-	-	-	X	-	-
Gochnatia polymorpha (Less.) Cabrera	-	-	-	-	X	-	X	-	-	X	-
Piptocarpha angustifolia Dusén ex Malme	-	X	-	-	X	-	X	-	X	X	X
Piptocarpha axillaris (Less.) Baker subsp. Axillaris	-	X	-	-	-	-	X	-	X	X	-
Piptocarpha tomentosa Baker	-	-	-	-	-	-	-	X	-	X	-
Vernonanthura discolor (Spreng.) H. Rob.	-	X	-	X	X	X	X	X	X	X	X
Bignoniaceae											
Jacaranda puberula Cham.	X	-	-	X	-	X	X	X	X	X	X

Canellaceae											
Cinnamodendron dinisii (Schwacke) Occhioni.	X	-	-	X	X	X	-	-	-	X	-
Cannabaceae											
Celtis ehrenbergiana (Klotzsch) Liebm.	-	-	-	-	-	X	-	-	X	-	-
Celtis iguanea (Jacq.) Sarg.	-	-	-	-	-	X	-	-	-	-	-
Cardiopteridaceae											
Citronella paniculata (Mart.) R.A.Howard.	-	-	-	-	-	-	-	-	X	-	-
Celastraceae											
Maytenus boaria Molina.	-	-	-	-	-	-	-	X	X	-	X
Maytenus cassineformis Reissek.	-	-	-	-	-	-	-	-	-	-	X
Maytenus ilicifolia Mart.exReissek	-	-	-	-	X	-	-	-	-	X	-
Maytenus muelleri Schwacke.	-	-	-	-	-	-	-	X	-	-	-
Chrysobalanaceae											
Hirtella hebeclada Moric. ex DC.	-	-	-	-	-	-	-	-	-	-	X
Clethraceae											
Clethra scabra Pers. var. scabra	-	-	-	X	-	X	X	X	X	X	X
Cyatheaceae											
Dicksonia sellowiana Hook.	-	-	-	-	-	-	-	-	-	-	X

Elaeocarpaceae											
Sloanea guianensis (Aubl.) Benth.	X	-	-	-	-	-	X	X	-	-	-
Sloanea monosperma Vell.	-	-	-	-	-	-	-	X	-	-	-
Erythroxylaceae											
Erythroxylum deciduum A. St.-Hil.	X	-	-	-	X	-	-	-	-	X	X
Erythroxylum argentinum O. E. Schulz	-	-	-	X	-	-	X	X	X	X	-
Euphorbiaceae											
Sapium glandulosum (L.) Morong	X	-	-	-	-	X	X	X	X	X	-
Sebastiania brasiliensis Spreng.	-	-	-	-	-	X	-	-	-	-	-
Sebastiania commersoniana (Baill.) L. B. Sm. & Downs	-	X	-	X	-	-	X	X	X	X	X
Sebastiania serrata (Klotzch) Müll.Arg.	-	-	-	-	-	-	-	-	X	-	X
Stillingia oppositifolia Baill. ex Müll.Arg.	-	-	-	-	-	-	-	-	-	X	-
Fabaceae											
Acacia bonariensis Gillies ex Hook. & Arn.	-	-	-	-	X	-	-	-	-	-	-
Dalbergia frutescens (Vell.) Britton	-	X	-	-	-	X	-	-	X	X	X
Lonchocarpus muehlbergianus Hassl.	-	-	-	-	-	X	X	X	X	X	-
Machaerium paraguariense Hassl.	-	-	-	-	-	X	-	X	X	-	-
Mimosa scabrella Benth.	-	-	X	-	-	X	X	-	X	-	X

Rhynchosia spp	-	-	-	-	-	X	-	X	X	X	-
Lamiaceae											
Aegiphila integrifolia (Jacq.) Moldenke	-	-	-	-	-	-	X	X	X	X	-
Vitex megapotamica (Spreng.) Moldenke	-	-	-	X	-	-	X	-	-	-	-
Lauraceae											
Cinnamomum amoenum (Nees & Mart.) Kosterm.	X	-	-	X	-	X	-	X	X	X	X
Cinnamomum glaziovii (Mez) Kosterm	-	-	-	-	-	-	-	-	X	-	-
Cinnamomum sellowianum (Nees & Mart.) Kosterm.	-	-	-	-	-	-	X	X	X	-	-
Nectandra angustifolia (Schrad.) Nees & Mart. ex Nees	-	-	-	-	-	-	-	-	X	-	-
Nectandra lanceolata Nees	X	-	-	-	-	X	-	-	-	X	X
Nectandra megapotamica (Spreng.) Mez	X	-	-	-	-	-	X	X	X	X	
Nectandra spp	-	-	-	-	-	-	-	-	-	-	X
Ocotea bicolor (Vattimo-Gil)	-	-	-	-	-	-	-	-	X	-	-
Ocotea catharinenses Mez	-	-	-	-	-	X	-	-	-	X	-
Ocotea diospyrifolia (Meisn.) Mez	X	-	-	-	-	X	-	X	X	X	-
Ocotea lanata (Nees & Mart.) Mez	-	-	-	-	-	-	X	-	-	-	-
Ocotea nutans (Nees) Mez	-	-	-	-	-	X	-	-	X	X	-
Ocotea porosa (Nees & Mart.) Barroso	-	X	-	-	X	X	X	X	X	X	X

Ocotea puberula (Rich.) Nees	X	-	-	-	X	X	X	X	X	X	X
Ocotea pulchella (Nees & Mart.) Mez		X	-	-	X	X	-	-	X	X	X
Ocotea silvestris Vattimo-Gil	X	-	-	-	-	X	-	-	-	-	X
Ocotea spp	X	-	-	-	-	-	-	-	-	-	X
Ocotea teleiandra (Meisn.) Mez	-	-	-	-	-	-	-	-	X	-	-
Persea major (Meisn.) L.E.Kopp	-	-	-	-	-	X	X	-	X	X	-
Loganiaceae											
Strychnos brasiliensis Mart.	-	-	-	-	X	-	-	-	-	X	X
Malvaceae											
Guazuma ulmifolia Lam.	-	-	-	-	-	X	-	-	-		X
Luehea divaricata Mart. & Zucc.	-	-	-	-	-	-	X	-	-	X	X
Melastomataceae											
Miconia cinerascens Miq. var. cinerascens	-	-	-	-	-	X	-	-	-	-	-
Miconia discolor DC.	-	-	-	-	-	X	-	-	-	X	X
Miconia ferruginea (Desr.) DC.	-	-	-	-	-	-	-	-	-	X	-
Miconia hyemalis A. St.-Hil. & Naudin	-	-	-	-	-	-	-	X	-	X	-
Miconia sellowiana Naudin.	-	-	-	X	-	-	X	X	-	-	-
Miconia spp	-	-	-	-	-	-	X	X	-	X	X
Tibouchina sellowiana (Cham.) Cogn.	-	-	-	X	-	-	X	X	X	X	-

Meliaceae											
Cabralea canjerana (Vell.) Mart. subsp. canjerana.	-	X	-	-	-	-	-	-	-	-	-
Cedrela fissilis Vell.	X	-	-	-	X	X	-	X	-	X	X
Trichilia elegans A. Juss. subsp. elegans.	-	-	-	-	-	X	-	-	-	X	-
Mimosaceae											
Calliandra parvifolia (Hook. f. & Arn.) Speg.	-	-	-	-	-	-	-	-	-	X	X
Calliandra tweediei Benth.	-	-	-	-	X	-	-	X	-	-	-
Inga lentiscifolia Benth.	-	X	-	-	-	-	-	-	-	-	-
Monimiaceae											
Mollinedia elegans Tul.	-	-	-	-	-	-	-	-	X	-	-
Mollinedia eugeniifolia Perkins.	-	-	-	-	-	-	-	-	X	-	-
Mollinedia schottiana (Spreng.) Perkins.	X	-	-	X	-	X	-	X	X	X	-
Myrsinaceae											
Myrsine coriacea (Sw.) R.Br. ex Roem. & Schult.	X	-	-	-	X	X	X	X	X	X	X
Myrsine umbellata Mart.	X	-	-	-	-	X	X	X	X	X	-
Myrtaceae											
Acca sellowiana (O.Berg) Burret	-	X	-	-	-	-	-	-	-	-	-
Blepharocalyx salicifolius (Kunth)	-	-	-	-	-	X	-	X	X	X	-

O.Berg											
Calyptranthes concinna DC.	-	-	-	-	-	-	-	X	-	-	-
Campomanesia rhombea O.Berg var. kleinii	X	-	-	X	X	X	-	X	-	X	X
Campomanesia xanthocarpa (Mart.) O.Berg	X	-	-	-	X	X	X	X	X	X	X
Curitiba prismatica (D.Legrand) Salywon & Landrum	X	X	-	X	X	X	X	X	X	X	X
Eugenia hiemalis Cambess.	-	-	-	-	-	X	-	-	-	-	-
Eugenia pluriflora DC.	X	-	-	-	X	X	-	-	-	X	-
Eugenia pyriformis Cambess.	-	-	-	-	-	-	-	-	X	-	-
Eugenia uniflora L.	-	-	-	-	X	X	-	-	X	X	-
Myrceugenia euosma (O.Berg) D.Legrand	-	-	-	-	-	-	-	-	-	X	-
Myrcia glabra (O.Berg) D.Legrand	-	-	-	-	-	-	-	X	X	-	-
Myrcia guianensis (Aubl.) DC.	-	-	-	-	-	-	X	-	X	X	X
Myrcia hartwegiana (O.Berg) Kiaersk.	-	-	-	-	X	-	X	X	X	X	X
Myrcia hatschbachii D.Legrand	-	-	-	-	-	-	-	-	X	-	-
Myrcia hebepetala DC.	-	-	-	-	-	-	-	-	X	-	-
Myrcia multiflora (Lam.) DC.	-	-	-	-	-	X	-	-	-	X	-
Myrcia laruotteana Cambess.	-	-	-	-	-	-	X	X	X	-	X
Myrcia palustris DC.	-	-	-	-	-	-	-	-	X	X	-

Myrcia selloi (Spreng.) N.Silveira	-	-	-	-	-	-	-	-	-	X	-
Myrcia splendens (Sw.) DC.	X	X	-	-	-	X	X	X	X	X	-
Myrcia spp	-	-	-	-	-	-	-	-	-	-	X
Myrcianthes gigantea (D. Legrand) D. Legrand	-	-	-	-	X	-	-	X	-	-	-
Neomitranthes cordifolia (D.Legrand) D.Legrand	-	-	-	-	-	-	-	-	X	-	-
Psidium cattleianum Sabine	X	-	-	-	-	-	-	X	X	-	X
Siphoneugena reitzii D.Legrand	-	-	-	-	X	-	-	-	-	-	-
Picramniaceae											
Picramnia parvifolia Engler	-	-	-	-	X	-	-	X	X	X	-
Proteaceae											
Roupala asplenioides Sleumer.	-	-	-	-	-	-	-	-	-	-	X
Roupala brasiliensis Klotzsch	-	-	-	-	-	X	X	X	X	-	-
Roupala rhombifolia Mart. ex Meisn.	-	-	-	-	-	-	-	-	-	-	X
Rhamnaceae											
Condalia buxifolia Reissek	-	-	-	-	-	-	-	-	-	X	-
Hovenia dulcis Thunb.	-	-	-	-	-	-	-	-	-	X	-
Rhamnus sphaerosperma Sw.	X	X	X	X	X	X	-	-	-	X	-
Scutia buxifolia Reissek	-	-	-	-	X	-	-	-	-	-	-
Rosaceae											

Prunus myrtifolia (L.) Urb.	-	-	-	X	X	-	X	X	X	X	X
Quillaja brasiliensis Martius	-	-	-	-	-	-	-	-	-	-	X
Rubiaceae											
Coussarea contracta (Walp.) Müll.Arg.	-	-	-	-	-	-	-	X	-	-	-
Palicourea australis C. M. Taylor.	-	-	-	-	-	-	-	-	-	-	X
Randia ferox (Cham. & Schltdl.) DC.	-	-	-	-	-	-	-	X	X	-	-
Rudgea parquioides (Cham.) Müll.Arg. subsp. parquioides	-	-	-	-	-	-	-	-	-	-	X
Rutaceae											
Zanthoxylum kleinii (R.S.Cowan) P.G.Waterman	-	-	-	X	-	-	-	X	X	-	X
Zanthoxylum fagara (L.) Sarg.	X	X	-	-	X	X	X	-	-	X	-
Zanthoxylum rhoifolium Lam.	-	-	-	X	-	X	-	-	-	X	X
Salicaceae											
Casearia decandra Jacq.	-	-	-	X	-	X	X	X	X	X	X
Casearia lasiophylla Eichler.	-	-	-	-	-	-	X	X	X	-	-
Casearia obliqua Spreng.	X	X	-	-	-	X	-	X	X	-	-
Casearia sylvestris Sw.	X	X	-	X	X	X	X	X	X	X	X
Xylosma pseudosalzmannii Sleumer.	-	-	-	-	-	X	-	-	-	X	X
Sapindaceae											
Allophylus edulis (A.St.-Hil. et al.)	X	X	-	-	X	X	X	X	X	X	-

Hieron. ex Niederl.											
Cupania vernalis Cambessedes.	-	-	-	-	X	X	-	-	-	X	X
Diatenopteryx sorbifolia Radlk.	-	-	-	-	-	-	-	-	-	X	-
Matayba elaegnoides Radlk.	X	-	-	X	X	X	X	X	X	X	X
Matayba guianensis Aubl.	-	-	-	-	-	-	-	-	-	-	X
Solanaceae											
Aureliana wettsteiniana (Witasek) Hunz.	-	-	-	-	-	-	-	-	X	-	X
Brunfelsia cuneifolia J.A.Schmidt	-	-	-	-	-	-	-	-	-	X	-
Cestrum intermedium Sendtn.	-	-	-	-	-	-	-	X	-	-	-
Cestrum strigilatum Ruiz & Pav.	-	-	-	X	X	-	X	-	X	X	-
Cyphomandra corymbiflora Sendtn.	-	-	-	-	-	-	-	-	X	X	-
Lycianthes rantonnei (Carrière) Bitter	-	-	-	-	-	-	X	-	X	-	X
Solanum pabstii L. B. Sm. & Downs	-	-	-	-	-	-	-	-	-	-	X
Solanum paranense Dusén	-	-	-	X	X	-	-	-	-	-	X
Solanum pseudoquina A. St.-Hil.	-	-	-	-	-	-	X	-	X	-	-
Solanum sanctaecatharinae Dunal	-	-	-	-	-	-	X	-	X	-	X
Solanum variabile Mart.	-	-	-	-	-	-	X	X	-	X	-
Solanum spp	-	-	-	X	-	-	-	-	-	-	-
Styracaceae											

Styrax leprosus Hook. & Arn	-	-	-	-	-	-	-	-	X	X	X
Symplocaceae											
Symplocos pentandra (Mattos) Occhioni ex Aranha	-	-	-	-	-	-	-	-	X	-	-
Symplocos trachycarpos Brand.	X	-	-	-	-	-	-	-	-	-	-
Symplocos tetrandra Mart.	-	-	-	-	-	-	-	-	X	-	X
Symplocos tenuifolia Brand.	-	-	-	-	-	-	-	X	-	-	-
Symplocos uniflora (Pohl) Benth.	-	-	-	-	-	-	-	-	-	-	X
Thymelaeaceae											
Daphnopsis racemosa Griseb.	-	-	-	-	-	-	-	-	-	X	-
Verbenaceae											
Duranta vestita Cham.	-	-	-	-	-	X	-	-	-	-	-
Winteraceae											
Drimys brasiliensis Miers	X	X	X	-	-	X	-	X	X	X	X